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THE NATIONAL GEOGRAPHIC MAGAZINE

OCTOBER, 1947

Map of Countries of the Caribbean

Including Mexico, Central America, and the West Indies

Our Navy Explores Antarctica

With 59 Illustrations and 3 Maps
11 Natural Color Photographs
REAR ADMIRAL RICHARD E. BYRD, USN, RET.

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THE NATIONAL GEOGRAPHIC MAGAZINE

Our Navy Explores Antarctica

By Rear Admiral Richard E. Byrd, USN, Ret.

With Illustrations from U. S. Navy Official Photographs

AT THE bottom of this planet lies an enchanted continent in the sky, like a pale sleeping princess.

Sinister and beautiful she lies in her frozen slumber, her billowy white robes of snow weirdly luminous with amethysts and emeralds of ice, her dreams iridescent ice halos around the sun and moon, her horizons painted with pastel shades of pink, gold, green, and blue.

Such is Antarctica, luring land of everlasting mystery. The ice-imprisoned continent covers almost 6,000,000 square miles of the earth's surface—nearly as much as South America. Most of the interior actually is less known than the sunlit side of the moon.

In the century since the land was discovered, fewer than 600 human beings have lived on its shores. Sirenlike, it challenges the restless, adventure-hungry postwar world.

Exploration a Navy Tradition

Last winter this challenge was accepted by the United States Navy, as part of its training and research activities, with the largest exploring expedition ever organized—thirteen ships manned by 4,000 men. It was the fifth, and by far the largest, polar expedition which I have led.*

Of the five, this was the first which was entirely naval, with the exception of a few Army and civilian observers and scientists.

Whatever I have been able to accomplish in the past as an explorer has been due largely to my training and experience as a naval officer, and to the Navy's spirit of fair play and justice that give importance and dignity to the individual.

Obviously, the technical education of any man who is to exercise command in this branch of our armed services must include most of the specialties of the professional geographer. He must be competent not only as a navigator but as a map maker, an astronomer, a sensitive and accurate observer of Nature.

Some of the foremost figures in the history of our naval service, both here and abroad, have been explorers—especially explorers of the polar regions. The American list is impressive and inspiring—Peary, Wilkes, Kane, De Long, and many others.

Among the outstanding names in the history of the Antarctic have been those of Capt. James Cook, Sir James Clark Ross, and Capt. Robert F. Scott. All were of the Royal Navy, and Sir Ernest Shackleton was of the Naval Reserve. Bellingshausen was a Russian naval officer, D'Urville a French naval captain. The story of polar exploration would fill a much smaller volume if the accomplishments of all these men were erased.

In the Navy, battles with storm, distance, cold, loneliness, and hunger stand nearly as high in the tradition of the service as battles with hostile fleets. The officer enters upon his career with this tradition as one of the impelling forces of his life.

* Admiral Byrd also was in command of the naval aviation unit of the MacMillan Arctic Expedition in 1925. See, in the National Geographic Magazine for November, 1925, "Flying Over the Arctic," by Lt. Comdr. Richard E. Byrd, and "MacMillan Arctic Expedition Returns," by Donald B. MacMillan. See also, by Admiral Byrd: "First Flight to the North Pole," September, 1926; "Conquest of Antarctica by Air," August, 1930; and "Exploring the Ice Age in Antarctica," October, 1935; and, by Capt. Ashley C. McKinley, "Mapping the Antarctic from the Air," October, 1952.

With Three of His Top Advisers, Admiral Byrd Plans an Exploring Flight

War against the grim powers of ice, snow, and wild Antarctic weather centered in this map-lined room. Behind the Admiral (left to right) are Capt. G. F. Kosco, expedition aerological officer in charge of scientific projects, and Comdr. C. M. Campbell, commander of the lure group. In foreground is Capt. H. R. Horney, Admiral Byrd's chief of staff.

So I was glad and proud to see the naval service return on such an impressive scale to the field for which it is so pre-eminently adapted by training, equipment, and history.

The project was, moreover, a means of demonstrating strikingly to the American people that their Navy is not alone "war insurance." It pays its way in services between wars. The code and spirit of the Navy are the finest things I have known in life or literature, and I consider them to be a great asset to the Nation in peace as well as in war. With great sincerity and a lifelong conviction I should like to say that I wish the people of this country could know our Navy as I do.

This great undertaking, the 1946-1947 U. S. Navy Antarctic Expedition, officially designated Operation Highjump, was made possible by the vision and enterprise of Secretary of the Navy James Forrestal and Fleet Admiral Chester W. Nimitz, Chief of Naval Operations. Vice Adm. Forrest P. Sherman, Deputy Chief of Naval Operations, assisted by Rear Adm. Roscoe F. Good, showed extraordinary foresight and initiative in making the general over-all plans and in implementing these plans.

To Capt. Richard H. Cruzen, veteran of our 1939-41 Antarctic Expedition, fell the job of doing most of the detailed organizing—a tough assignment indeed. He was put in command of Task Force 68, as the expedition's ships were known collectively, upon my recommendation. Just before the departure of the expedition, Cruzen was promoted by the Selection Board to the grade of Rear Admiral.

This delighted me, as it was what I had hoped for. Further, it would make Cruzen's job and mine easier.

The Navy was considerably handicapped because of the short time that was available (this was unavoidable) for organizing and

Good Hunting! They'll Have "Sealburgers" and Seal Steak Tonight

While the ships of the Central Group were stalled in the Ross ice pack, a hunting party was organized and a crabeater seal killed. In the hunting party were (left to right): Dr. H. H. Howe, of the U. S. Coast and Geodetic Survey; Dr. H. H. Richardson, assistant staff medical officer; Jack E. Perkins, expedition biologist and representative of the U. S. Fish and Wildlife Service; and Dr. Paul A. Siple, senior representative of the War Department. Ordinarily, seal meat is used only for dog food.

readying the expedition. From these pages it can be seen how well the above-mentioned officers overcame this handicap.

I was designated Officer in Charge of Operation Highjump, and as such represented Fleet Admiral Nimitz during the preparation and while operating in the Antarctic.

Encirclement of Continent Planned

A major objective was to sail with two task groups, each with a seaplane tender, as far as possible around the 16,000-mile coast of the roughly circular continent (map, pp. 436-7).

Most of the coastline, as shown on present maps, is largely conjectural. It has little more relation to reality than had some of the grotesque 16th-century maps of America used by pioneer explorers who crossed the Atlantic.

From our seaplane tenders it was proposed to launch planes at various points to explore the coast itself and make flights inland.

Another major and very important objective was to have the main group of ships—the Central Group—establish a base for ski-equipped landplanes which would make long exploring and photo-reconnaissance journeys over the unmapped interior of the continent itself.

To sum up, the plan was to attack the continent on three fronts.

One group of three ships would move eastward from the 90th west meridian and proceed as far as possible toward the meridian of Greenwich (0°), which approximately bisects Queen Maud Land east of the Weddell Sea.

Another would start from the Balleny Islands, south of New Zealand, and proceed westward until it met the first group.

Each of these groups carried three PBM flying boats and three crews. The planes were to be launched from the open sea just north of the ice pack, photograph the coast, and fly inland as far as possible.

Between these two operated the Central Group, with a base on the ice near the Bay of Whales. Its ski-equipped planes were to operate over an arc of about 80 degrees of longitude in which lies the Ross Sea.

Thus there was a chance that a complete circle could be closed around the continent. It was hoped that in a few weeks more would be learned of the great unknown than had come from a century of previous exploration by land and sea (maps, pp. 436-7, 467, 495).

Success of our plan was dependent on a reasonable amount of good flying weather. Ordinarily, one expects a total of little more than a week a month of clear calm days during January and February, even with the unbroken daylight during which missions could be sent out at any time during the 24 hours.

War Gave Explorers New Weapons

From the war there was a heritage of powerful new weapons which could be adapted to exploration and turned from fighting men to overcoming the even more malevolent elements which guard the secrets of Antarctica.

Our aircraft were equipped with all the marvelous photo-reconnaissance tools developed during the war.

Of great significance was the war-developed science of trimetrogon photography with the interpretation, and translation into maps, of photographs taken from the air. Since 1939 its techniques had undergone remarkable advances to meet the needs of the Air Forces and of general military intelligence.

For the purposes of the map maker the method is no different in principle from the triangulation techniques of surveyors on the ground, but there is a thousandfold increase in speed. There is also the advantage of showing what the countryside looks like and of revealing even minute details which would not be grasped by the naked eye (page 506).

Before us was the job of photographing much of the face of a continent, of combining in an enormous composite picture the topographical features of several million square miles. We knew that our Air Forces had mapped in this way most of North Africa and western Europe in the face of hailstorms of flak and the opposition of enemy fighters.

Here, in place of an armed enemy, were bad visibility, fog, Antarctic blizzards, and trackless immensities of cloud which formed without warning.

For the first time, Antarctic explorers were equipped with that uncanny instrument, the air-borne magnetometer, by which it was possible to determine the nature of the rock under the great icecap which covers the bottom of the world and to learn something of its mineral composition (page 509).

Still another weapon which could be adapted for conquest of the Antarctic and which had undergone remarkable development during the war was the icebreaker, as exemplified by the 6,660-ton, 10,000-horsepower Coast Guard icebreaker *Northwind* and the Navy's brand-new *Burton Island*. Both these ships accompanied the expedition.

Either could smash, slash, and wrestle almost indefinitely through solid pack ice up to eight feet thick. Thus was greatly simplified the problem of getting through the frozen seas which girdle the continent. The difficulties made me wonder how we ever got through the ice pack before with our 200- to 600-horsepower tiny wooden ships.

A mighty asset was the modern aircraft carrier, from which we planned to fly planes direct to Antarctica.

In short, it was our job to fashion all these swords into plowshares for the peaceful but perilous work of exploration.

New Age of Exploration

Equally as important as immediate geographical discovery was the responsibility of learning to use these marvelous new instruments, to test them under extreme conditions, to ascertain and devise means of overcoming their defects. In this respect we were pioneers, trail blazers of exploration's new age.*

Accompanying the expedition and distributed among the various ships were distinguished Army, Navy, and civilian scientists directed by Capt. George F. Kosco, USN.

The chief War Department representative was Dr. Paul A. Siple, Lt. Col., U. S. Army Reserve, whom I regard as the foremost living Antarctic geographer and authority on Antarctic problems.

He first came south with me as a Boy Scout in 1928. Since then he has been with all my

* Rear Admiral Richard E. Byrd, the first man to fly over the North and South Poles and the only one to fly over both, has looked upon more square miles of unknown area than any human in all history. He served in aviation with distinction in both World Wars; in the last one he was overseas four times and was cited or decorated four times. He had charge of the navigational preparations for the first successful transatlantic flight in history, made by the Navy in 1919. He flew nonstop to France in 1927, several weeks after Charles Lindbergh made the flight. His naval record shows twelve mentions of bravery, which include two citations for extraordinary heroism. He has the Congressional Medal of Honor, the Congressional Lifesaving Medal, three specially voted Congressional Medals, and nearly every other medal within the power of the United States Government to bestow.—The Editor.

Strange Brood for a "Fighting Lady": Six Big Douglas Landplanes, Antarctic-bound, on the Deck of the Carrier *Philippine Sea* in the Panama Canal

A dramatic highlight of the Navy's Antarctic expedition was the take-off of these heavy transports for a flight over the ice pack to Little America (pages 454 and 443). Because of their extensive wingspread and danger of running into the "island," right, only half of the deck was available for their historic take-off run.

Antarctica Next Stop! Six Heavy Landplanes Taking Off from the Aircraft Carrier *Philippine Sea* Made Aviation History

Plumes of smoke jet from the rocket-propulsion JATO bottles as they boost the R4D into the air with a deafening noise. All six planes, largest ever launched from a carrier, successfully made the 800-mile hop to Little America. Dual landing gear, consisting of skis with three inches of wheel protruding, enabled the planes to roll off the deck into the air and land on the big "barrel staves" on the snows of Antarctica (page 512).

expeditions, and his contribution to south polar science is in my opinion far greater than that of any man living or dead.

Siple has an intimate knowledge and broad grasp of everything associated with south polar regions. He is the only human being who refers to this land as "my own country." To Siple a return to Little America is "coming home." His advice and the assistance he gave the scientific group were invaluable.

For the last 25 years I have run across Army officers and men all over the world, and I have received from them personally the highest courtesy and hospitality and officially only the fullest cooperation.

This is especially true of World War II, in which I served under Army officers and over them when they were attached to my staff.

On this expedition, as always, it was a joy to work in the field with the Army. I recommend strongly that the next large polar expedition be made a joint Army-Navy project.

Central Group Battles Ross Ice Pack

The five ships of the Central Group of Task Force 68, with Rear Admiral Cruzen in direct command and Capt. Robert S. Quackenbush, Jr., always a tower of strength, as Chief of Staff, gathered on the last day of the year around a coal-black rock looming out of the ocean among hundreds of blue-and-white icebergs north of the Ross Sea. This is Scott Island, only land above water within a radius of more than 300 miles, and probably the best-

known landmark south of the Antarctic Circle.

Soundings by Drs. J. L. Hough and W. G. Metcalf of the Woods Hole Oceanographic Institution showed that the island is the flat-topped peak of one of a pair of submarine mountains, each nearly two miles high. The second peak, hitherto unknown, comes within about 200 feet of the surface. This was the first notable geographic discovery of the expedition.

For a century the Ross Sea has been recognized as the best approach to the interior of the Antarctic Continent. It is a large wedge-shaped shallow bay which, including its great ice shelf, cuts into the land for more than 1,000 miles. It starts near the 70th parallel, south latitude, and is roughly bisected by the 180th meridian, the International date line.

For about 700 miles there is usually, in summer, either open water or relatively loose pack ice. The pack, which varies in area from year to year, generally is concentrated near the northern boundary and must be traversed to reach the open water.

The sea ends abruptly at an ice wall from 40 to 80 feet high—the edge of the Ross Shelf Ice. This is a smooth, occasionally crevassed sheet, several hundred feet thick and about the size of California, stretching southward to the foot of the Queen Maud Range, which rims the great Polar Plateau.

An Epic of Navigation

The penetration of the Ross pack by the Central Group—the Coast Guard icebreaker *Northwind*, the command ship *Mount Olympus*, the freight carriers *Yancey* and *Merrick*, and, at the outset, the submarine *Seawolf*—became an epic of navigation.

It started on New Year's Eve.

A seaplane reconnaissance had indicated to Admiral Cruzen that the ice was thin and soft, with numerous lanes of open water between the floes. It appeared that the thin-shelled ships with hulls only about a half-inch thick would be in little danger of being dented or punctured in the pack drift.

This soon proved a delusion. The dawn of 1947 found the vessels already south of the area of floating, slushy chunks. At midnight the seascape was solid white as far as eye could see in any direction, except for a very few widely scattered green pools. A wind change immediately after the air observations apparently had solidified the white desert.

For two full weeks the expedition wrestled and traded punches with angry, belligerent ice. Sometimes the ships went forward only two or three miles a day on their way to the Bay of Whales, 800 miles distant. At one time, for three days, the ice carried them backwards about six miles a day (Plates IV-V).

Worst Ice Conditions in Century

Within the next few days it became obvious that this was the worst pack encountered in the 106 years since Sir James Clark Ross first pushed through the sea which bears his name. His ships, the *Erebus* and *Terror*, in early January, 1841, had bucked only 195 miles of ice.

Captain Scott's *Terra Nova* in December, 1910, had to push through more than 425 miles of fairly solid ice—an ill omen for the expedition that was to end in the greatest tragedy of south polar explorations.

Lincoln Ellsworth's *Wyatt Earp* in 1933 encountered one of the worst packs up to now—525 miles of thick, crushing whiteness.*

A few weeks later I sailed through the pack in the vicinity of the 169th meridian in an unprotected ship without seeing any pack. In January, 1940, Cruzen and I sailed through in twenty hours.

I have been through the pack a number of times and am convinced that it follows some sort of pattern in its behavior from year to year, but this is so complicated and so many unknown factors are involved that at present it is unpredictable. This constitutes one of the many problems of the Antarctic that await solution through the patient accumulation and coordination of observations.

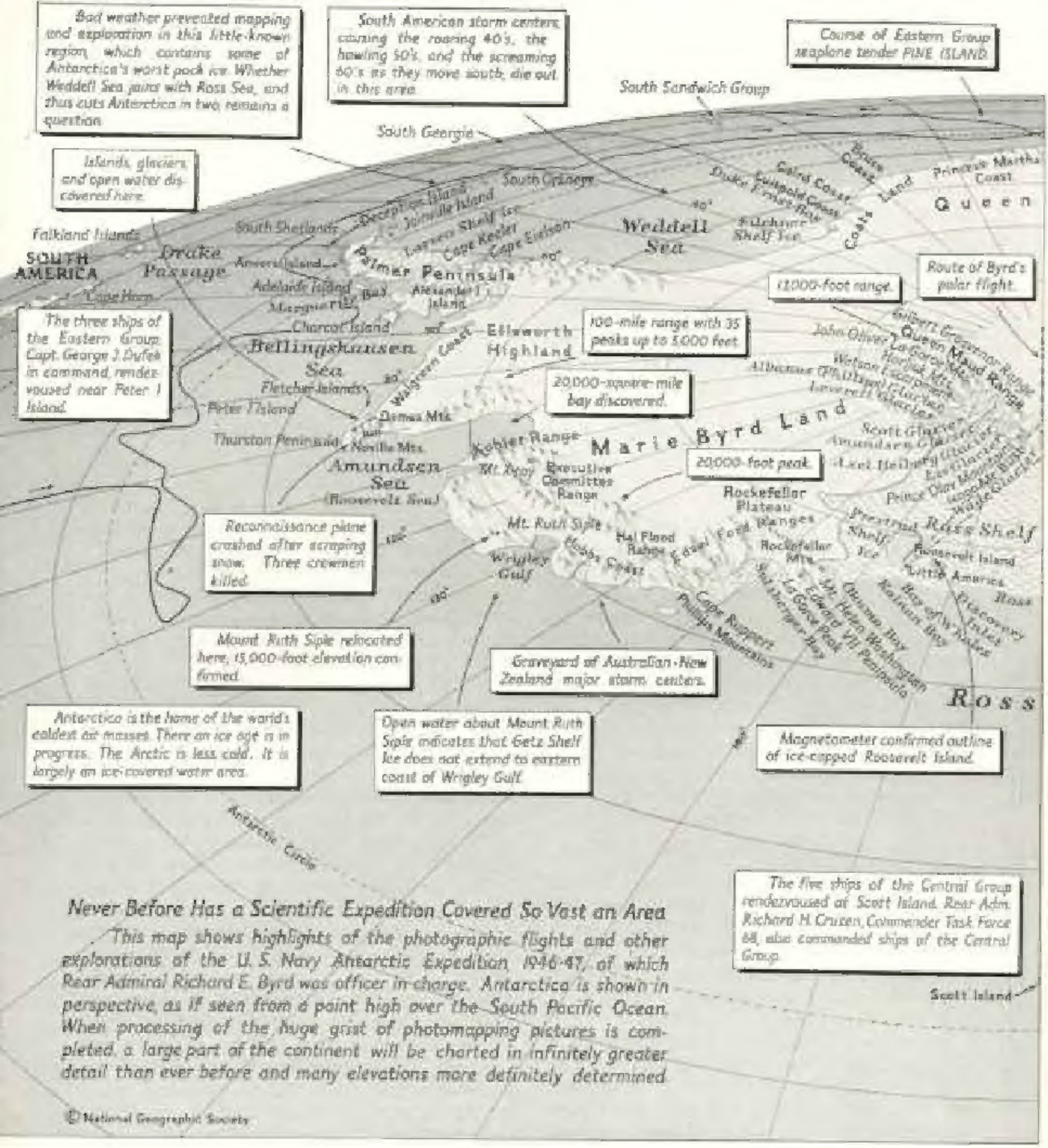
The ice has a general northwesterly drift. Every summer, it seems likely, there is a relatively open roadway somewhere which might be located by air observations. These would require time and a great deal of patience. Time, it must be remembered, is very precious when one can expect, at the best, only a few weeks of good weather.

Getting back through the pack is likely to prove a much more difficult problem than getting through it in the first place. It is hard to guess when the ice will reconsolidate into a thick, unbroken sheet which will be impassable for any ship.

Late in the season this may happen very quickly and without much warning. In 1930, for example, we barely escaped being trapped at Little America for another winter.

The eastern group of our 1941 expedition actually was trapped at Marguerite Bay by the suddenly re-formed pack, and it was necessary to evacuate them by air, an extremely perilous procedure.

* See, by Lincoln Ellsworth, in the NATIONAL GEOGRAPHIC MAGAZINE, "My Flight Across Antarctica," July, 1936, and "My Four Antarctic Expeditions," July, 1939.



Never Before Has a Scientific Expedition Covered So Vast an Area

This map shows highlights of the photographic flights and other explorations of the U. S. Navy Antarctic Expedition, 1946-47, of which Rear Admiral Richard E. Byrd was officer in charge. Antarctica is shown in perspective, as if seen from a point high over the South Pacific Ocean. When processing of the huge grist of photomapping pictures is completed, a large part of the continent will be charted in infinitely greater detail than ever before and many elevations more definitely determined.

Safe escape from the pack may be a matter of hours. This was to become a serious possibility before the Antarctic summer ended.

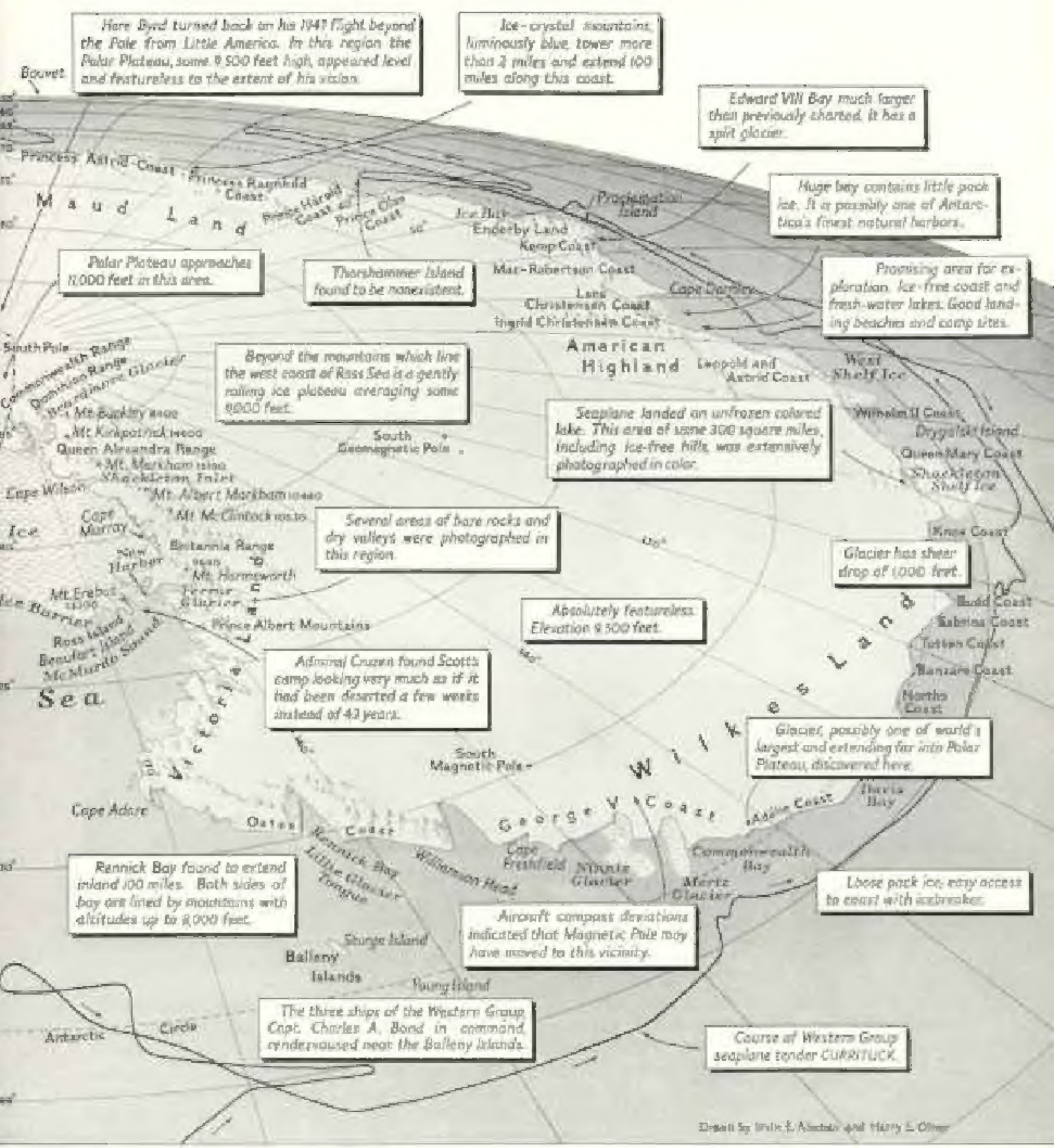
This year, on the trip south, Admiral Cruzen found an astounding contrast to what we had known before—approximately 600 miles from Scott Island to open water through ice from one to 30 feet thick.

Much of this was thin, not more than four feet thick, and "rotten." The solid structure of the frozen surface of the sea was undergoing rapid disintegration.

This, however, was crisscrossed by ribs of thick hard ice which had broken from the rim around the continent the summer before and floated northward to become integrated with the pack. Occasionally such ribs would be several miles wide. They were like steel walls in the path of the ships.

For the most part, this ice field was unbroken by leads or pools of open water. During the voyage only two large lakes were found in the desert, and these served as havens for days at a time.

"Desert" is a good descriptive word for the pack. The ice is covered with about a foot



of snow. This snow is dry, with the texture of fine sand.

Sturdy Icebreaker Runs Interference

The *Northwind*, commanded by Capt. Charles W. Thomas of the Coast Guard, one of the best ice sailors living, led the way.

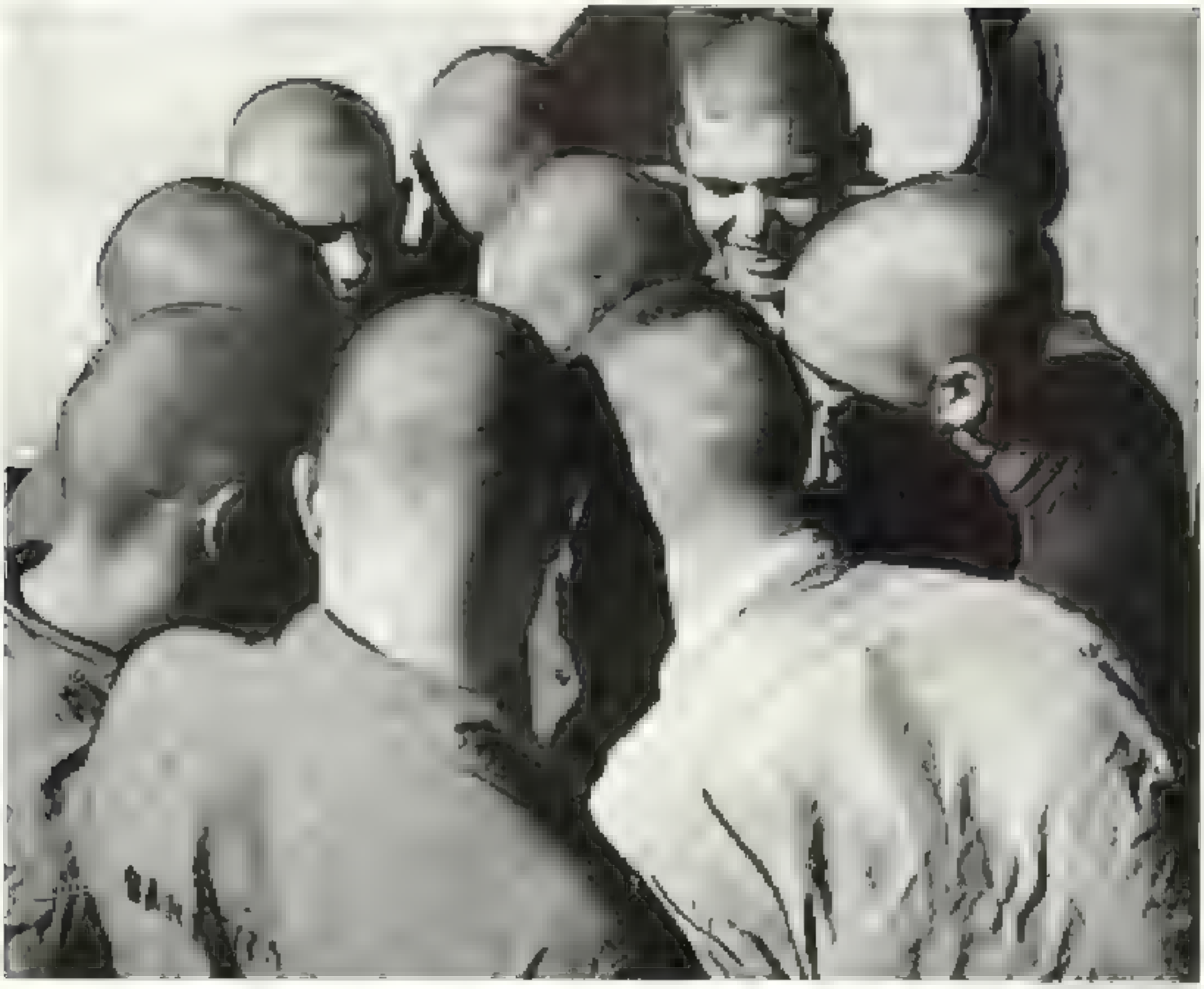
Before the 10,000-horsepower punches of this 6,660-ton icebreaker, one of the three or four toughest ships in existence, the pack offered little resistance.

Her slashing, crushing bow could push through ordinary three-foot ice smoothly at 10 knots, and one wall 30 feet thick was battered down in less than an hour. She could twist and turn in solid ice almost as easily as the other ships could maneuver in water.

The difficulty was that the unprotected ships could not follow the sharp-curved, narrow lanes she cut; loosened ice chunks piled in front of them, and the yawning jaws of ice pried open by the *Northwind* threatened to close on them relentlessly with pressures of many thousands of tons.

It soon became obvious that they might be in real danger of becoming crushed in the pack. All suffered dented hulls.

Before the end of the first week the peril



"Don't Worry: There Aren't Any Women Where We're Going"

[illegible]

[illegible]

[illegible]

A Master of Ship Navigation

[illegible]

[illegible]

"Who Said an Explorer's Life Was Tough?"

Seaman William Collins eats turkey on Christmas Day as the Mount Olympus nears the floe he pack

[illegible] in wild rumors which spread [illegible] Long delays and the weird fortunes of fog and white darkness.

That he was a determined, fearless, and resourceful leader I fully appreciated from my long association with him on our previous [illegible] Antarctic waters. That [illegible] and [illegible] why [illegible] to Admiral Nimitz that he be put in [illegible] and the experience [illegible] Admiral Cruzen of an unrivaled place among the great explorers of [illegible]

A [illegible] narrow break was sighted in the [illegible] It was the entrance to [illegible] Bay of Whales, the best harbor in Antarctica where ships can be anchored and plan[illegible] based within flying distance of the South Pole.

The entrance was less than 300 yards wide seven years ago, when Admiral Cruzen had last sailed with us between these pillars of ice; they had been one and a half miles apart. A helicopter survey showed that the bay itself was [illegible] and-a-half miles deep.

The Bay of Whales was frozen over five to eight feet thick and even up to 15 or 20 in places. This made it impossible to [illegible] except [illegible] the next three days the weather prevented [illegible] heat sink of [illegible] tons of hard ice, thus making it possible for the other ships to enter and unload their [illegible] of building materials for camp and [illegible] space 518

Ice Masses Wage Titanic War

What had happened in the [illegible] years since our last expedition?

[illegible] this Bay of Whales has [illegible] in a titanic elemental [illegible]

[illegible] It is the meeting place of two independent systems of this world

From a Pontoon-equipped Helicopter, Eyes in the Air Guide Ships on the Icy Sea

Present techniques of getting through the ice pack are to send a helicopter ahead of an icebreaker to spot leads of open water or thin ice. The expedition demonstrates that the helicopter is a valuable new aid to Antarctic exploration. Its ability to rise vertically [illegible] makes it especially suited to this task. Here the [illegible] pack ice as was seldom encountered on this expedition (page 456).

One is the Ross Shelf. It is about 100,000 square miles in area, and according to seismic measurements it varies from 500 to more than 800 feet in thickness counting, of course, the part that is under the water. It weighs several billion tons. It is moving northward about four feet each day.

The movement is due to the plastic nature of ice itself. Like any rock—and ice is only a somewhat aberrant variety of rock—it flows under the tremendous pressure of its own weight.

The other section is the so-called Filchner Shelf, named for the Norwegian naval lieutenant who first crossed it. The northwest end, at the Bay of Whales, is moving westward, also about four feet a day.

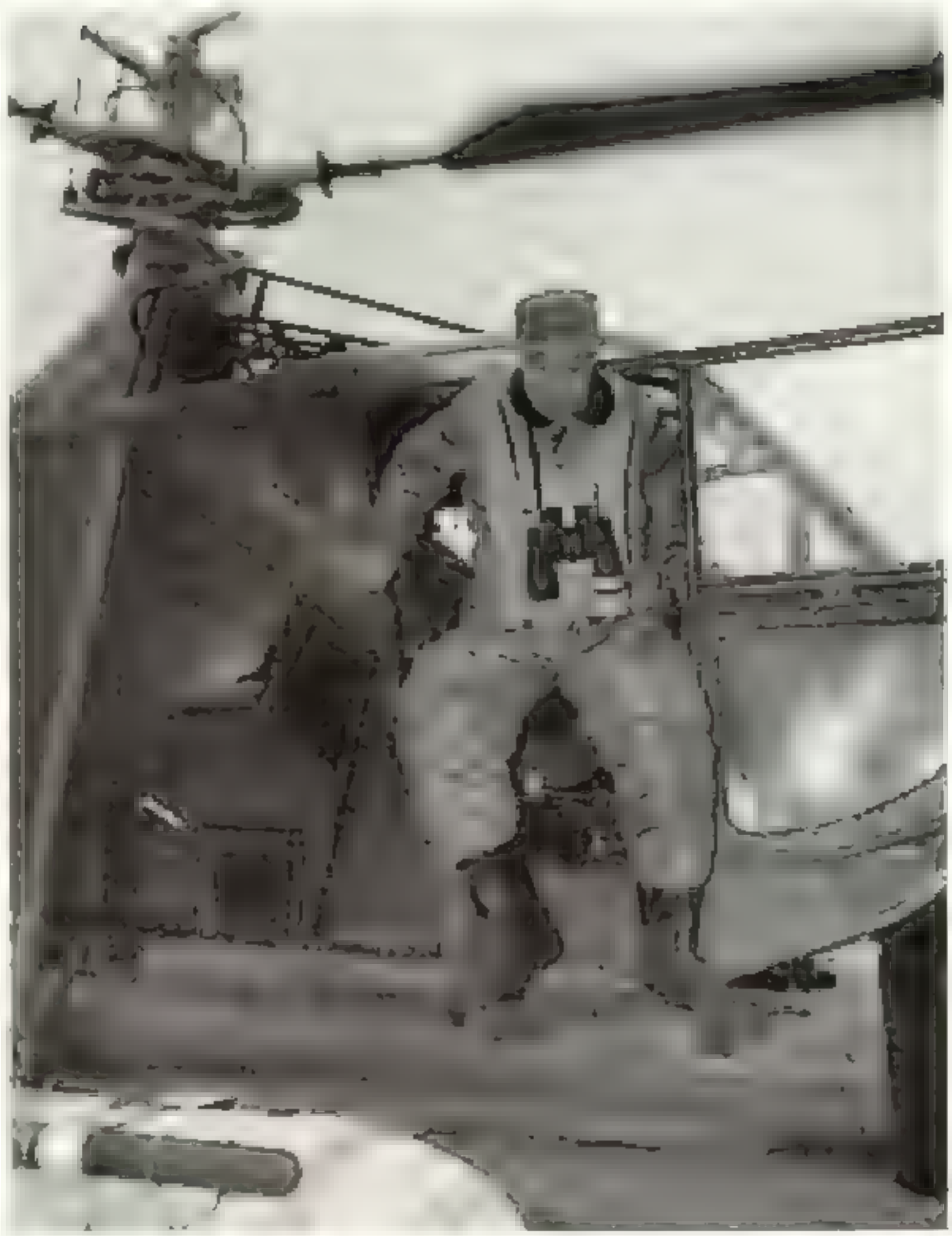
Between these two the bay constantly grows narrower and narrower. At intervals of varying length—perhaps 50 years would be a fair average—the two ice sheets come together with a force that is irresistible.

Bay Wiped Out, Then Reborn

At the time of such a collision the Bay of Whales becomes nonexistent. There is only an unbroken wall of ice from 40 to 70 or 80 feet high looming over the Ross Sea. Freshly broken faces may even exceed 100 feet in height in this area.

But this opportune break in the barrier cannot permanently disappear. Something must give way. High shelves are being built up continually by the accumulation of snow and the ice flow from behind. The pressure of the incalculable enormous icecap that covers the Antarctic Continent is back of them.

Usually great chunks of both shelves are broken off and pushed into the open sea where they float slowly northward as gigantic icebergs. It is possible that a single cake of ice as much as 800 square miles in area might be broken from the Ross Shelf. Icebergs more than 20 miles in length have been sighted in adjacent waters.



Rear Admiral Crazee Leaves His "Flying Crow's-nest"

[illegible]

[illegible] 10 miles wide and 10 miles deep when first charted by [illegible] in 1911. Each succeeding expedition [illegible]

[illegible] dire predictions [illegible] there would be [illegible] a broad curve in the [illegible] that would afford little [illegible]

[illegible] due in about six [illegible]

[illegible] 1931. [illegible] hinterland [illegible] the forest of [illegible] blue hills and villages which might have been [illegible] fairy-tale books (Plate VII). There was [illegible] which the heavy [illegible] by weasel tractors (page [illegible]

Little America Moved 1½ Miles

About two [illegible] rolling [illegible] masts and [illegible] last Little America [illegible]

[illegible] moved [illegible] 5,000 feet or [illegible] toward the northwest since [illegible] in 1929. The buildings were imbedded completely in the Prestrud Shelf and less part in [illegible]

A strange spectacle met the eyes of men [illegible] the first expedition—Dr. Spike himself [illegible] Vernon H. Brown and Lt. Commander [illegible] after the last [illegible] to lower [illegible] through a [illegible] into the well-remembered [illegible]

[illegible]

They found themselves [illegible] palace throne room [illegible]

"I Checked with the Sun Compass All the Way to the Pole and Back"—Admiral Byrd

[illegible] National Geographic Society. [illegible] the Pole."

refuse. Such was the accumulation [illegible] winter's [illegible] 1947.

[illegible] with [illegible] [illegible] [illegible] [illegible] The walls [illegible] [illegible]

They were [illegible] [illegible] through tunnel, between the buildings. Visible through a [illegible] of crystals [illegible] [illegible] night of 1940-41. The [illegible] their own names [illegible] with tribute to the [illegible]

[illegible] they [illegible] themselves [illegible] [illegible] human eyes have rarely seen [illegible] of sunlight passing through about eight feet of Antarctic snow.

The [illegible] was [illegible] roof with snow [illegible] above it. Presumably the strange color effect was due to light [illegible] by the snow crystals, so that the [illegible] extremely [illegible]

Six-year-old Steak Still Edible

[illegible], bread, butter, and candy left [illegible] in excellent condition after six years, and the party ate a [illegible] meal from the [illegible] provisions.

The buildings [illegible] had proven [illegible] refrigerator, [illegible] of the year [illegible] temperature of [illegible], although [illegible] from [illegible] above freezing to 70 or 75 below zero, Fahrenheit.

This was the third Little America. The first one had been set up in [illegible] 1929 at a point about 15 miles from the present northern edge of the Ross Ice Barrier. Then the Bay of Whales [illegible] later [illegible] the barrier ice.

When we returned in [illegible] we had seen [illegible] and radio towers [illegible] about 30 feet above the snow accumulation. They had been [illegible] feet high when we erected them in [illegible]

Family Reunion in Panama: Her Nose Knows the Pups Are Hers

When the *Mount Olympus* left Norfolk, Virginia, some Husky puppies were still [illegible]. [illegible] to Panama [illegible] the expedition [illegible] [illegible] [illegible].

only about 16 feet of their height remained visible. [illegible] [illegible] [illegible] and [illegible] [illegible] there at a [illegible] of several [illegible].

The second Little America had been [illegible] [illegible] [illegible] [illegible] [illegible]; [illegible] the [illegible] [illegible] about eight feet it had been possible to make use of our old tunnels and some of our old buildings. We had, then, literally a two-layered city. [illegible] [illegible] [illegible] [illegible] the second city [illegible] had been completely [illegible].

One night, without any warning, the ice where our camp was [illegible] [illegible] [illegible] [illegible] the barrier. [illegible] [illegible] [illegible] [illegible] and lowered [illegible] [illegible] [illegible]. For a while it had looked as if Little America might [illegible] [illegible] [illegible] [illegible]. In the [illegible] [illegible] emergency, a very cold spell had hit us and the barrier [illegible] [illegible] consolidated again about as rapidly as it had split apart.

The third Little America, the one [illegible] visited by Siple, was about four miles from the [illegible] [illegible] and six miles north of the first one.

Here, [illegible] were many of the [illegible] [illegible] [illegible] Antarctic [illegible], the [illegible] [illegible] among the most [illegible] [illegible] [illegible]. These birds [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] gathered about in little flocks, showing no fear of [illegible] [illegible] [illegible] [illegible] [illegible].

Just over the edge of the ice shelf a tent camp was set up with accommodations for 300 men. This was the fourth Little America, about two miles north of the third.

Its construction was a major engineering job, considering the difficulty of transferring all necessary supplies from the ships over a [illegible]-foot high crevassed rise which was the [illegible] point between the sea ice and the permanent shelf ice. Near [illegible] [illegible] [illegible] [illegible] planes [illegible] [illegible] [illegible] [illegible].

Tense Take-off from the *Philippine Sea*

Now all was in readiness at Little America for [illegible] [illegible] [illegible] of the [illegible] aerial exploration of the great unknown interior of the Polar Plateau and the walls of high mountains to the east, west, and south.

This was to be accomplished by six R4D planes en route on a carrier in the Pacific. The R4D is the Navy version of the Douglas C-47, the twin-motored transport which has been called "the workhorse of the war." Each carried a crew of five men, was equipped for take-offs and landings either on wheels or

skis and was loaded with photographic and other scientific equipment.

Such craft, it was calculated, could fly missions inland for as much as 850 miles with sufficient fuel for safe return. This would make possible flights from Little America to slightly beyond the South Pole.

The planes arrived in the vicinity of Scott Island, at the edge of the ice pack, on the *Philippine Sea* late in January.

When one considers the comparatively small, underpowered, overloaded ships that had been used on previous expeditions, one can appreciate what it meant to me to find [illegible] my flag on the *Philippine Sea*, one of our great modern carriers, sailing the northern edge of the vast Ross Sea ice pack within plane distance of Little America.

Growlers, icebergs, and heavy pack are to a thin-skinned aircraft carrier as dangerous as rocks. The great Antarctic icebergs are smaller, sinister-looking monsters, especially when dimly seen in thick weather.

One can therefore understand the initial anxiety of the commanding officer of the *Philippine Sea*, Capt. Delbert S. Cornwell. He was locked in strange waters and thousands of miles off his beaten route. However, when he found that even in the thickest weather the icebergs would show up on the radar, he began to take things more casually. Cornwell was a very fine officer to work with.

The six large R4Ds on the *Philippine Sea* were a very pleasing sight indeed, but also a strange sight—ski planes on the deck of a carrier (page 433).

Biggest Ever Flown from a Carrier

It would be unthinkable to attempt to get the *Philippine Sea* through 600 miles of ice pack to Little America. Therefore, we would have to fly these large planes from the carrier. This project would constitute another important pioneering effort in aviation.

The great question was: Could we do it? Unfortunately, because of the little time we had in preparation, we had not been able to carry out a test hop from the carrier deck.

This would be the largest plane ever flown from a carrier.*

Because of the wingspread, we would have to take off forward of the "island," the superstructure which rises above the flight deck amidships on the starboard side and houses the main controls.

Thus we would have only half of the runway, or approximately 400 feet, for the take-off instead of the 640 feet that are the maximum available to the smaller carrier planes.

On top of that handicap, the wheels would protrude only about three inches under the skis, and the least swerve on the deck might cause the ski to strike the deck and throw the plane overboard.

The reason we could allow no more than three inches was the danger of capsizing on the snow at Little America if we allowed more of the wheel to show.

It was a situation where we had to figure carefully and compromise on the safety factors at each end of the flight.

Captain Cornwell naturally wanted six inches of the wheel to show, which would have given us a better chance to get off the carrier safely, but six inches at the other end would almost certainly have capsized the planes on landing (page 512).

Further, only a few of the pilots and co-pilots had ever flown from carriers before. Added to our problems was the fact that we would have to fly near the South Magnetic Pole, which would be on our starboard hand going south (map, pages 436-7).

Rocket-propulsion Tubes Aid Take-off

We had decided to assist our take-offs with JATO bottles, rocket-propulsion tubes, about the size of ordinary fire extinguishers, which are attached to the sides of the fuselage.

Theoretically, such launchings seemed entirely practicable—but until calculations have been checked by actual tests there always remains an element of doubt. Had every possible factor been considered? We were betting our lives on figures on a sheet of paper.

Some extra safety was provided by eliminating heavy equipment, [illegible] for high-altitude fli[illegible] must be remembered that almost any Antarctic flight is at high altitudes.

We would take off at a slight angle to the center line of the ship, so that if we should crash into the sea we would not be run over by our high-speed carrier.

We decided to fly to Little America in pairs. If the first pair should reach it all right and land safely, then there was a good chance that the other four planes could make it O.K. Just in case the ski-wheel arrangement should capsize us at Little America, we wanted to be certain not to crack up all six planes.

Success in the venture required sufficiently good visibility for the *Philippine Sea*, while making a 30-mile run at 30 knots, to avoid growlers, bergs, and ice floes. Also, we would not want too much of a sea running. We suffered a discouraging delay of a week, awaiting suitable weather.

* General Doolittle's B-25 bombers had a smaller wingspread than the R4Ds.

Raised over Lower America IV, the Flag Was Left Flying in the Face of Antarctic Blasts

Such Skis-equipped High Jumpers Explored Hundreds of Miles of Antarctica

Science but Microscopic Amongst the Antarctic Ice-Covered Rocks

[illegible]

TBMFs—Many Marauders Roost on the *Plain Island*. They Mapped Innumerable Areas

With Needed Supplies, Explorers Keep Busy as They Sail Deep South

Ice Chronicles : L'Antarctica Circa: the Expedition in the Ross Sea

[illegible]

Some Ice Cakes Were So Big That World Was Considered Flat

On Guard Against the Freezing of Starting Ray Jet, the Cargo Ships Lower and Moorings Are Ready to Cast Off at a Moment's Notice

Heavy Tracks, Like Those Now Used in the Antarctica, were Put Down Ahead of Snow Tractors to Make a Path

"Dog Teams" Still Serve the Wide Use of Snow Tractors Today. Dogs Are Still Useful in Rough, Crevassed Country

Bare Rocks and Vivid Lakes Appear Strange Oasis in a Desert of White

Finally, on January 29, we got a break in the weather both at our position and at Little America, 800 miles away. The commanding officer of the R4D unit, Comdr. William M. Hawkes, and I, with Hawkes at the wheel, were to take off in the first plane with an additional crew of four. We climbed aboard the plane and stood by for Captain Cromwell to head the carrier into the wind.

From the vibration of our great carrier I knew when the Captain had got the ship up to about 30 knots and it was time to take off.

We seemed to creep along the deck at first, and it looked as if we could never make it with only 400 feet for a plane that usually required a 2,500-foot runway. But when our four JATO bottles went off along the sides of the plane with a terrific, deafening noise I could see the deck fall away (page 434). I knew that we had made it. We had crossed our first river.

Flying by Sun Compass

Luckily, the weather had remained sufficiently clear to use the sun compass (page 442) as we flew near the South Magnetic Pole. There was a lot of ice and I had an unparalleled opportunity to study the pack. I believe we saw more ice pack that day than earth-bound explorers would see in a lifetime.

Hours later, when we had left the ice pack behind and found the Ross Sea barrier opening up before us, I noted that the effect on my companions, who thought they had seen everything, was as if they had taken several drinks of strong wine. I felt exhilarated, though I had for long periods lived under the spows of this great natural wonder of the world.

The exhilaration vanished when we reached Little America and saw the rough condition of the snow landing field. A recent storm, I learned later, had thrown up hard sastrugi. We would have preferred making our first ski-wheel landing on a smoother field. We circled a long time and looked things over carefully before letting down. It was a tense moment. The landing was rough enough to capsize most planes, but the rugged R4D took it. Another river was crossed.

I knew that I had witnessed another landmark set along the road of aviation's amazing progress. Captain Cromwell and Commander Hawkes and the officers and men of his unit had done well.

I am convinced now that the take-offs from the carrier would have been possible without the jet tubes. With their help, and with a redesigned flight deck, it appears feasible to launch from a carrier even much larger planes with a range of 8,000 miles and capable of carrying a much heavier load.

There has been some discussion whether the carrier, which played such a dramatic and essential part in our Pacific war, may not have become essentially an obsolete weapon with the development of larger planes with much longer flight ranges. Our experience in the Antarctic should be an adequate answer.

Why, it may be asked, use a carrier for a bomber that can fly 8,000 miles? There would be few targets more than 4,000 miles away. But it always must be kept in mind that, as a general rule, the shorter the distance that must be flown the greater the load of destruction for the enemy.

These flights also demonstrated the complete practicability of taking off from the deck on wheels and landing on skis. The wheels should be retractable through slots in the big "barrel staves" after the planes are in the air.

The object lesson in all this should be obvious. The shortest distance between the New and Old Worlds is across the Arctic Ocean and the north polar regions. It is freely predicted that here will be one of the great battle areas of future wars.

Our long-range bombers—or those of another power—could be brought by carrier to the edge of the northern ice and sent across the top of the world.

Risks Carefully Calculated

Those six planes looked mighty fine lined up facing into the prevailing wind there at Little America IV, poised to fly into the unknown as soon as we could "ready" them.

Little America IV was rapidly being "shaken down" under the efficient leadership of Comdr. Clifford M. Campbell, an experienced aviator and one of the most cooperative officers I have ever come in contact with. Aside from the scientific projects under Captain Kosco and the engineering experiments of Comdr. Charles O. Reinhardt (who was also the expedition and camp engineer), activities of the camp revolved around our aviation mission.

The successful accomplishment of this mission would involve serious hazards. In fact, some of us were much concerned about the safety of the crews and passengers of the planes.

It had always been my policy on each previous expedition to risk the lives of my men only when it was a reasonable risk, and a necessary one to accomplish the mission of the expedition. Even though this rule is followed, there are many occasions when explorers have to take extremely hazardous chances to succeed. When such chances have to be taken, I believe in calculating the risk with the greatest of care.

Antarctic Beachhead: Unloading the Cargo Ships Thorsheimfjord and Wanoa on the Ice of the Bay of Whales

This expedition, generally speaking, was different from the former ones in that I could not, because of the chain of command setup and the numerous separated, far-flung units, have close personal contact with all the various projects. However, at Little America I was able to carry on as of old and had the opportunity to work closely with Campbell and Hawkes to do everything possible to achieve what we wanted most: namely, to accomplish the mission without losing any men.

I had already had close contact with the personnel of the R4D unit on the way south on the *Philippine Sea*. Commander Hawkes and his staff and my chief of staff, Capt. Harry R. Horney, and I had spent days on the carrier discussing the many problems ahead of us in the most minute detail. Five hours on end, and often late into the night, we would assess the uncertainties and attempt to work out methods of meeting them (page 450).

Capacity for Taking Pains

Hawkes [illegible] great capacity for taking [illegible] Captain Horney, an old-time [illegible] pilot and now at Little America, [illegible], checked with [illegible] and had [illegible] suggestions of his own.

Many factors handicapped us. In the first place, the maintenance and readying of the R4Ds for the long flights was a tough job in the cold without benefit of hangars.

Because of the ski-wheel arrangement and the shape of the R4D fuselage, we could not design the skis as large as we would have liked for the heavy loads we would have to carry on our long flights.

That raised the question of how these big planes would perform on skis when flying with very heavy loads from the névé. They had never been fairly tested, and, further, only Lieutenant Commander McCoy of the Navy pilots had had any real experience in ski flying.

In Antarctica the best flying season for safety and results is in November and December. The weather is best then, and there would be more time for rescue operations in case of a forced landing far from base. To carry on rescue operations after the long winter night descended would mean casualties.

But to explore in the early summer it is necessary to spend the winter night on the continent, because it is generally not possible for any ships but the new icebreakers to get through the ice of the Ross Sea until the Antarctic midsummer day is past.

There is thus a serious handicap for a summer season expedition expecting to achieve any notable results in discovery. We had, of course, planned carefully in Washington to overcome this handicap, but we actually had a far shorter flying season than the short one we had planned for.

It came about this way.

We had, as is seen, used up the good summer flying weather getting through the ice pack to Little America. On top of that, the early consolidation of the ice pack made it necessary to evacuate the vulnerable ships weeks ahead of our scheduled date lest they be forced to winter at Little America. This would have resulted in the loss of the ships.

Accordingly, Crozier, on February 6 instead of the middle of March as planned, headed north with all the ships of the Central Group before we had made a single major flight. An icebreaker would return to Little America for us, but even this sturdy ship would have to depart weeks ahead of the scheduled date.

The loss of flying time was not the only handicap this imposed on us. Among other things, it meant that to all practical purposes we would have no radar to guide the fliers back to base, nor would we have at our disposal the wonderful facilities in material and personnel provided by the ships.

It may be thought that I have dwelt unduly on our predicament, but the fact is that I have understated the difficulties, which only a few on the expedition understood.

So great was the pessimism of those "in the know" that they felt that our R4D mission was doomed to failure.

Versatility and Leadership

But the doubters didn't count on the versatility of the Navy in general, and in particular the leadership of Campbell, the amazing coordinating ability of Horney, the super-loyalty and selflessness of the enlisted personnel, and the ingenuity and ability of Hawkes. He was a pilot of exceptional skill, an aviation engineer, and a fine leader and inspirer of men.

But Hawkes was more than that. From boyhood he had been an enthusiast about polar exploration. He was steeped in the lore of Arctic and Antarctic. Flying over these wastes of ice was for him fulfillment of a lifetime's dream.

I have mentioned one of the question marks: the take-off of the R4Ds. First, the pressure of such heavy planes would turn the Antarctic névé upon which they rested into ice which would stick to the skis. Would we be able to get the planes started?

Secondly, if we could get started, would this same pressure—which made a very heavy load per unit of area of the skis—give the

Past Icebergs Like Floating Cliffs of Dover, the Ships Approach Antarctica

Ahead of the flagship *Mount Olympus* steam the cargo ships *Pamanzi*, *Merrick* and the icebreaker *Northwind*

landing gears too much of a beating as we took off on the rough terrain? Thirdly, would we be able to get up enough speed to rise into the air?

We [illegible] these points. On February [illegible] the ships left, we were ready for a flight of discovery with a heavy load of gas aboard and with the wheels removed from the landing gear. The slot in the skis where the wheels had been was filled in with duralumin.

Hawkes at the wheel pushed the throttle forward to full power (which we knew is bad for the engines). We didn't budge. Men on the snow rocked the plane from the wing tips to loosen up the skis from the snow. The vibration was terrible and the whole plane took a beating, but still we hadn't moved an inch.

Then [illegible] planks under the skis [illegible] finally got moving, very slowly [illegible]. Hawkes set off the Jato bottles; they literally [illegible] us off the rough snow (page 685).

Soon we ran into bad weather with zero visibility and [illegible] minutes later we suffered a gasoline leak from one of the midship tanks into the [illegible]. The violent vibration had [illegible] it.

[illegible] things can happen. We had to turn back. That was disappointing, but we had shown that a large ski-equipped plane such as the R4D could be taken off the névé with a very heavy load. This was another river crossed.

[illegible] Tragedy, with its rapidly sinking sun [illegible] depressing cold. There were no weather stations, as in the States, to help us with forecasting good weather at our targets and, what was even more important, to insure us against impossible landing conditions on our return.

By the old method of waiting at Little America for the weather, the chances were ten [illegible] allowing even a reasonable [illegible] We had to develop a new technique [illegible].

Our technique was to send planes out to scout for the weather, and, further, while exploring, to take the weather where we could find it. We knew that would mean that we would seldom be able to follow a predetermined flight track.

His technique, of course, would not insure against bad weather back at the base. That chance would have to be taken.

In carrying out this plan we had splendid assistance from the meteorologists, Captain Kosco and Mr. B. C. Haynes, of the U. S. Weather Bureau. They deserve great credit.

Mapped Vast Area Never Before Seen

It had been calculated that our whole program could be accomplished by 25 missions—that is, 25 single plane flights—with good visibility for photography.

Actually, when the flying was finished and the [illegible] was in, 29 operational flights had

Emerging from the Pack at Last They Sail On Toward the Great Ice Barrier

The ring of open Ross Sea water adjacent the frozen continent is due to prevailing ocean currents

been made by planes of the Central Group. Of these, 17 were successful and three partly successful. Nine accomplished very little, because of weather conditions or mechanical troubles. The planes spent 220 hours in the air on operational and mapping mission. They flew approximately 27,500 miles, exclusive of local and test flights (maps, pages 404 and 405).

In each plane were mounted two oblique aerial cameras. One pointed straight down. Two were pointed downward at angles of 30 degrees from the horizontal, thus sweeping from horizon to horizon.

A fourth camera photographed a clock and other recording devices in the plane itself.

A fifth camera formed part of the radio altimeter apparatus which, by means of radio pulse echoes, continuously recorded the altitude of the plane above the ground.

Four cameras were operated by an automatic device which clicked them simultaneously several times a minute, the number depending on the plane's speed and altitude.

A plane equipped with such a battery of cameras could photograph in rough fashion about 100,000 square miles—such as a strip 850 miles deep and 70 miles wide both going and coming—under ideal conditions.

Following is a résumé of the accomplishments of this group, before considering the experiences on individual missions.

Several islands in the Ross Sea, which hitherto had escaped detection because they were buried under the Ross Shelf Ice, were discovered.

The exact location of the east coast of the Ross Sea always has been a mystery, because it rises so gradually in many parts that it is difficult to tell where the sea ends and the land begins under the unchanging white surface of the névé. This expedition found evidence for determination of several precise points on this shore line.

An important project was mapping the Bay of Whales area.

The 1947 front of the Ross Ice Barrier was photographed. This barrier changes every year, and maps from previous expeditions when compared with ours will provide valuable data on the movements of a great ice block 400 miles long and 400 miles wide.

In the course of this work several new bays, inlets, tension cracks, and crevasses in the barrier were discovered and mapped. The relative rates and directions of ice movements for the central and eastern sections of the shelf were investigated.

At least three major mountain ranges hitherto entirely unknown were discovered. Incidental to this was the discovery of at least one, and probably several, mountains of 16,000 to 20,000 feet elevation.

These rank easily among the highest mountains in the world. Precise elevations cannot be determined until photographs are studied.

Low-decked and Fragile, the Submarine *Sennet* Gets Help from the Burly *Northwind*

Soon after the Central Group entered the Ross Sea [illegible] that submarines are [illegible] Little America [illegible] take [illegible] in tow [illegible] [illegible] commander of the expedition and [illegible]

We discovered literally hundreds of mountains [illegible] never seen [illegible]. Some [illegible] rose to elevations of at least 15,000 feet.

[illegible] were discovered. The [illegible] and [illegible] of these also depend on processing of the photographs in the Washington laboratories.

More than [illegible] square miles of the [illegible] were [illegible] from an average [illegible] feet [illegible] the edge of the Antarctic. One of the more colorful discoveries was that of several fairly large areas of [illegible] rock surface among the mountain ranges which border the [illegible] shore of the Ross Sea.

All a Result of Two Weeks' Flying

All this was accomplished in only about two weeks of [illegible] excellent flying weather. It was essential that we remain constantly alert, that the planes and their crews be ready to take off at any time when there was a favorable break in the weather.

[illegible] of exploration. [illegible] is the thrill of [illegible] looked on [illegible] where no human being has [illegible] the earth beneath.

All this can be conveyed, although quite inadequately, only through a [illegible] of the personal experiences and reactions of the men who made the flights from Little America into the unknown [illegible]. Despite the hardships [illegible] all of them have expressed a desire to return. They have been caught, as have so many before them, by the [illegible] of the Antarctic.

The two planes which crossed the South

From His Dizzy Perch He Views the Crashing Progress of an Icebreaker

A Navy motion-picture cameraman [illegible] by crane to record [illegible] of the Navy icebreaker *Burton Island* [illegible] Antarctic [illegible] Inset: a temporary [illegible] The *Burton Island*, on her maiden voyage, [illegible] in mid-February 1947 and reached the Bay of Whales in time to evacuate the 140 men at Little America before a fierce [illegible] could [illegible] the [illegible] men [illegible] months.

Pole left Little America exactly after 11 p. m. on February 1.

Off to Explore Beyond the Pole

The flight into the area beyond the Pole had been set down in our plans as one of the major flight objectives.

About [illegible] in Operation Knight [illegible] the weather was fair, the visibility good and [illegible] we had to take advantage of it we probably would not get another chance in that direction [illegible] We had two planes standing by to fly in whatever direction the weather was good.

It was a tense take-off. The temperature was 18 below zero. Selected Jato bottles were rocket-assisted to the rear of a jet-powered ship, were [illegible] Commander Blackburn had information that they would [illegible] prematurely at subzero temperatures.

The pressure gauge showed the oil pressure in our engine was too low to permit leaving the ground. But the more we [illegible] up the engine to increase the pressure the colder the Jato bottles were getting.

It was essential that we [illegible]. We took a chance on the pressure that only the bottle in the gauge [illegible] were [illegible] and that the oil pressure actually was sufficient. This proved to be the case.

Take-off a Calculated Risk

The decision to take off on the longest flight of the expedition was hard to make under such circumstances. But there probably would not be another such break in the weather, which would last for only a few hours. If we had waited and then have hours would be required to warm the Jato bottles to safe operating temperature. It seemed to be a question of staying then for

the area beyond the Pole, or not at all. Little more good weather in that direction could be expected this season.

Pilots of the leading plane, in which I rode, were Lt. George H. Anderson and my old associate, Lieutenant Commander McCoy, veteran of Antarctic aviation.

McCoy had been with me on a previous expedition. He is, I believe, the most experienced living pilot in the peculiar conditions of the south polar regions—resourceful, level-headed, conservative, a splendid comrade and a gallant gentleman.

Anderson was new to the Antarctic, but the skill he displayed was of a high order. Lt. (jg) Robert P. Heskin was navigator.

Completing our crew were J. E. Walsh, aviation radioman, first-class, and K. C. Swan, photographer, first-class.

Immediately behind us was a plane in which Commander Campbell rode as senior, with Maj. Robert R. Weir as pilot, Capt. Eugene C. McIntyre as co-pilot, and Capt. Raymond J. Butters as navigator. The radioman was M. Sgt. A. V. Mincey and the photographer was Sgt. George E. Baldwin.

We were glad to have these fine Marine Corps officers and men with us.

The two planes were greatly overloaded. That is the sort of thing an explorer is always forced to contend with.

The maximum gross weight officially allowed was 25,000 pounds. This would have permitted us to take only about 1,000 gallons of gasoline—far from sufficient to reach the Pole. We carried 1,400 gallons, and the personnel and equipment raised the gross weight of each aircraft to over 32,000 pounds.

Ideal Day for Longest Flight

It was an ideal day for our longest flight mission. The sky ahead was cloudless. Visibility was nearly perfect. From the plane we could see nearly 150 miles in any direction.

Under the vault of the purple-blue sky we proceeded straight across the Ross Shelf Ice just west of the 100-mile-long, saddle-backed Roosevelt Island which rose like a hump in the ice. The surface below us, rippled and ridged by the wind, was a brilliant white, singed with blue and gold.

We passed over the terribly crevassed area which lies in front of the Queen Maud Range and constitutes one of the formidable barriers to any land expedition seeking to enter the continent from this direction.

Far below us stretched the blue and purple chasms of the crevasses. They were many miles long and shaped like horseshoes with the ends pointing south. Some of the huge crevasses were wide enough to swallow destroyers.

We were flying into the strange sunset of the Antarctic's late-summer midnight. The sun was low, a great ball like a red wheel rolling along our horizon just a few feet above it. In another week it would dip below that horizon for the first time this year.

Heating System Paralyzed by Cold

The temperature dropped steadily. The heating system and automatic pilots refused to work, congealed by cold. Anderson's ears began to freeze. My own hands stuck to the metal of my sun compass (page 442).

Vibration loosened fittings on the extra fuel tanks and gasoline fumes filled the plane aft of the cockpit. I had to tighten the fittings every few minutes.

We were approaching the Wade Glacier from the northeast across scattered low mountains of fantastic shapes, some with bare black crests and some snow-covered.

Here one of the engines stopped. Why, nobody knows. It started again when we switched to another gas tank, and we had no further trouble with it for the rest of the trip.

The windows began to fog badly inside the cockpit because of the failure of the heating system. I took my turn in the co-pilot's seat, and McCoy and I were kept busy scraping away the frost with our knives. It was a continuous operation and very uncomfortable since the ice formed with amazing rapidity on the glass.

Then we turned into the glacier itself—a vast silver river about 14 miles wide flowing between high walls of ice (page 470). This appears to be one of the best gateways to the Polar Plateau, either by land or by air. It cuts through a great chaotic array of low-lying peaks which increase progressively in height to the southward.

Seemingly without end they stretched around us—a scene of grandeur such as hardly is equitable on earth. The wheeling sun shaded the glacier.

Dominating the entire Wade Glacier area to our left, that great Beacon sandstone mass, Mount Bush, towered to an altitude of approximately 14,000 feet.

In the glacier below we noted one curious feature. Like a wriggling snake along the west bank of this enormous ice river was a serpentinely curving brown strip about 300 feet wide and extending for approximately 35 miles. For many minutes it lay in sight below the plane. This appeared to be an ice-free strip, seemingly filled with chaotically piled brownish rocks.

McCoy and I gave much attention to this

Three-point Landing Will Not a Pilot: Lowering the Norseman Scouting Plane into the Bay Ice from the Deck of the *Mount Olympus*

[illegible] A new explanation of the strip at [illegible] conjectural. It [illegible] possible [illegible] period of [illegible] occurs near where several [illegible] streams join the Wade. There was no fog rising from it, as would be expected [illegible] were any subterranean [illegible]

Bedtime for the Pole

When we emerged from the lee cover the latitude of the Pole [illegible] for, although some of the [illegible] must have been blind.

A [illegible] the glacier we [illegible] toward the Pole. The spectacle to the right [illegible] some I have ever seen. To the west lay the Dominion Range [illegible] to be the southernmost mountain range [illegible] Gilbert Grosvenor [illegible] had [illegible] the National [illegible]

[illegible] I had [illegible] the Pole [illegible] the sun compass from back there. This compass [illegible] ings were causing a severe drift. We got a [illegible]

[illegible] to form on the windshield [illegible] the plane's cockpit. The glass was kept [illegible] engine [illegible] rolled up [illegible]

We had no oxygen equipment. The effects

Like Ink Dots on a White Sheet Appear the Tents of Little America IV

At the base of Operation Highjump, as the Navy called its exploration of the continent, was this tent city on the edge of the Ross Shelf Ice. The dazzlship *Mount Olympus* and the cargo ships *Pecory* and *Merrick* are moored in the Bay of Whales. In the lower left-hand corner is the galley and mess tent. In about the center of the picture is the air operations section, with an airstrip for ski-equipped planes.

of anoxia soon became apparent in the unco-ordinated speech, staggering gait, and happy-go-lucky attitude of some members of the crew.

Probably the alcohol fumes the men were inhaling and the bitter cold accentuated the effects of flying for so long a period at such high altitudes without oxygen. The victims themselves appeared to be unaware of these symptoms.

Some of the things they said seemed funny at the time—at least they seemed so to me, but I would not want to vouch for myself.

At about latitude 83 there was a considerable rise in the altitude of the plateau to approximately 10,000 feet. After a few miles this altitude drops again to approximately 9,500 feet at the Pole itself. This increase in height was noted by both Scott and Amundsen on their land journeys.

There apparently is a hump for at least several hundred miles across the face of the plateau, with some evidence of an increasing altitude westward of our flight line. Probably it indicates a mountain range buried under the snow.

Sastrugi Indicate Wind Direction

All the way across the plateau I observed the sastrugi, the straight, almost parallel, windrows of névé piled up by the winds, which are a feature of all Antarctic landscapes.

They are a sure guide to the prevailing winds of a region, giving information which meteorological observers on the surface would require months to accumulate.

I deduced from them that the prevailing winds on the Ross Sea side of the continent from the Pole are from the southeast.

All the time we continued flying as closely as possible along the 180th meridian. Even without wind drift, for which adequate corrections could be made, it is obvious that no navigator can fly along a mathematical line.

Consequently, since this is the international date line, we were zigzagging constantly from today into tomorrow and back again. But sticking as closely as possible to the meridian made easier the navigation, difficult at best, toward what is only a mathematical point on the earth's surface.

Air navigation in polar regions affords problems of peculiar difficulty.

Near the Magnetic Poles the ordinary compass as a guide to direction becomes so unreliable as to be practically useless. Much of the time the sun and the pale outline of the moon visible during the 24-hour long Antarctic day are hidden behind clouds, leaving no celestial guides over the trackless wastes where eventually, at the South Pole, all directions merge into an all-encompassing North.

Navigation in other parts of the world today is largely by various types of electronic direction finders. There are of course no permanent installations of this sort south of the Antarctic Circle, and our young Navy pilots, at least in the Central (Little America) Group had to learn to navigate without the benefit of electronic aids such as they had used during their flying career.

Twenty minutes away from the Pole I tapped Navigator Heekin on the shoulder. I had been keeping something up my sleeve.

"Know how to tell when we are over the Pole?" I asked. "It will be when the altitude of the sun and its declination are equal."

This was a rule-of-thumb equation which I had formulated for myself long before the days of the present ultra-refined methods of navigation.

Heekin nodded. Throughout the flight I had checked our course with the sun compass and I had observed that he was doing a fine job. I was confident that he would find the Pole unaided. Captain's plane was following us.

Byrd's Second Visit to the South Pole

Heekin took observations every moment or so now, at almost exactly 5 a. m. he gave the signal. We were crossing the mathematical bottom of the world. My hat is off to Heekin.*

For the fourth time in history human beings were at the South Pole. For the second time I was looking down upon it.

The South Pole simply is the geographical farthest south. It is physically indistinguishable from any other point on the plateau, and, except for the aerial photographic record, a [illegible] no longer adds anything of importance to our knowledge of the Antarctic regions.

The Pole has been a symbol of achievement, of the surmounting of Nature's greatest barriers by man's determination and ingenuity.

In the air age this symbol is no longer valid. Except for details, the nature and contour of the country from the rim of mountains around the Ross Sea to the bottom of the world can be rather accurately described either from direct observations or from almost unquestionably reliable deductions.

But all successful polar expeditions by land or air have been from this direction. In any other direction from the Pole the nature of the plateau is completely unknown.

Except from the neighborhood of the Ross Ice Barrier, the South Pole until recently has been considered well nigh unattainable. In fact, a point somewhere in the neighborhood of 78 south latitude on the 70th east meridian has been designated as "the pole of inaccessibility," supposedly the most difficult spot left on earth for man to reach.

Into Mystery Land Beyond the Pole

It had been one of the major objectives of the Navy to penetrate beyond the Pole into this "area of inaccessibility," the vastest unknown which remains in the world.

When one speaks of "beyond the South Pole" the language is not entirely figurative. The Pole is, of course, by definition the farthest south possible to reach, but it hardly is a midway point towards what now must be the goal of Antarctic exploration—the interior of those millions of square miles which no eye has seen.

When we were a few minutes beyond the Pole both planes turned to port and flew in a circle around it. This was, for me, the third nonstop flight around the world.

At the Pole it seemed—and this is an impression subject to correction—that the sastrugi were smaller and less well defined than elsewhere. They may indicate that the South Pole itself is not a place of high winds, so characteristic of much of Antarctica.

Below us the snow surface had a slight metallic sheen. Where the sun struck at angles it was tinged with gold. I dropped a cardboard box containing multicolored little flags of the United Nations. The symbolism

* Captain Ruthven in the other plane checked Heekin's position.

Changing Ashore with a Heavy Hawser, Scanlon Moor the Vessel Olympus to a Pier of Ice
While Cargo Ships Unload

Expedition Members Haul the Flagship's Steam Line to a "Deadman" Sunk in the Ice at the Bay of Whales. Page 178

should be obvious—the dedication of this goal of so much selfless heroism of the Norwegians and the British to the ideal of brotherhood among peoples.

Then, on the back of my navigation chart, I printed a personal message to Fleet Admiral Nimitz in Washington. My hands were so cold I had difficulty holding the pencil.

I wondered lately if this message could have been legible and examined the chart with a good deal of curiosity.

I wondered if there would be any evidence of the giddiness which comes from lack of oxygen and the fumes of the alcohol which we were using every few minutes to keep the cockpit window clear of frost.

What I wrote seems to have been entirely rational, although the message looks somewhat like the writing of a child who has just learned to print the alphabet. It read:

"It is 13:47 G. A. T. [Greenwich Apparent Time]

"As I write this, we are circling the South Pole. The temperature is 40 below zero.* Our altitude is 12,000 feet. The Pole is approximately 2,500 feet below us. On the other side of the Pole we are looking into that vast unknown area we have struggled so hard to reach. We are dropping on the Pole the flags of the United Nations.

"The young men with me join in sending to you and to the Secretary of the Navy our gratitude for giving us this opportunity for geographical discovery and great adventure. As this message is finished, we are heading into the unknown beyond the Pole. Warm regards from a cold place to you, Duke, and Forrest. There is no heat in the plane and it is chilly."

The reference to Duke and Forrest was to Adm. De Witt C. Ramsey, Vice Chief of Naval Operations, and Vice Admiral Sherman, who had done so much to make the expedition possible (page 430).

Only "Rolling White Desert" Seen

Both planes then continued on beyond the Pole. The instant we passed it some interesting things happened.

First, though we were following the same straight line, our true course changed from south to north and our 180th meridian changed to the zero meridian. Second, west had become east and east west.

In other words, one moment we were looking eastward out of the port window, and the next we had crossed the Pole and were looking westward out of the same window.

We flew to approximately latitude 88.30 south, an estimated 100 miles. Then we made approximately a right-angle turn eastward until we reached the 45th east meridian, when we turned again, this time on our way back to Little America.

Altogether, we had surveyed nearly 10,000 square miles of "the country beyond the Pole."

As was to be expected, although it is somewhat disappointing to report, there was no observable feature of any significance beyond the Pole. There was only the rolling white desert from horizon to horizon.

Visibility continued perfect, probably 150 miles. At one time, far to the northward in the direction of South America, I thought I discerned mountains, but this was little more than a passing impression. I am doubtful.

Our course was planned to take us over unknown areas practically all the way back to the Beardmore Glacier, toward which we now headed (page 473). Until this expedition discovered a glacier which is very probably larger (pages 473 and 478-9), the great Beardmore was supposed to be the earth's largest ice river.

Along this broad, crevassed white highway through towering mountains both Shackleton and Scott had made their land dashes toward the Pole. I hoped that it would be possible to set our course over the glacier itself.

A message received at this time from Little America, however, warned that weather was closing in there. This made a shorter route home advisable. But this turned out to be fortunate, because the flight was over hitherto unexplored country between the Beardmore and Wade Glaciers.

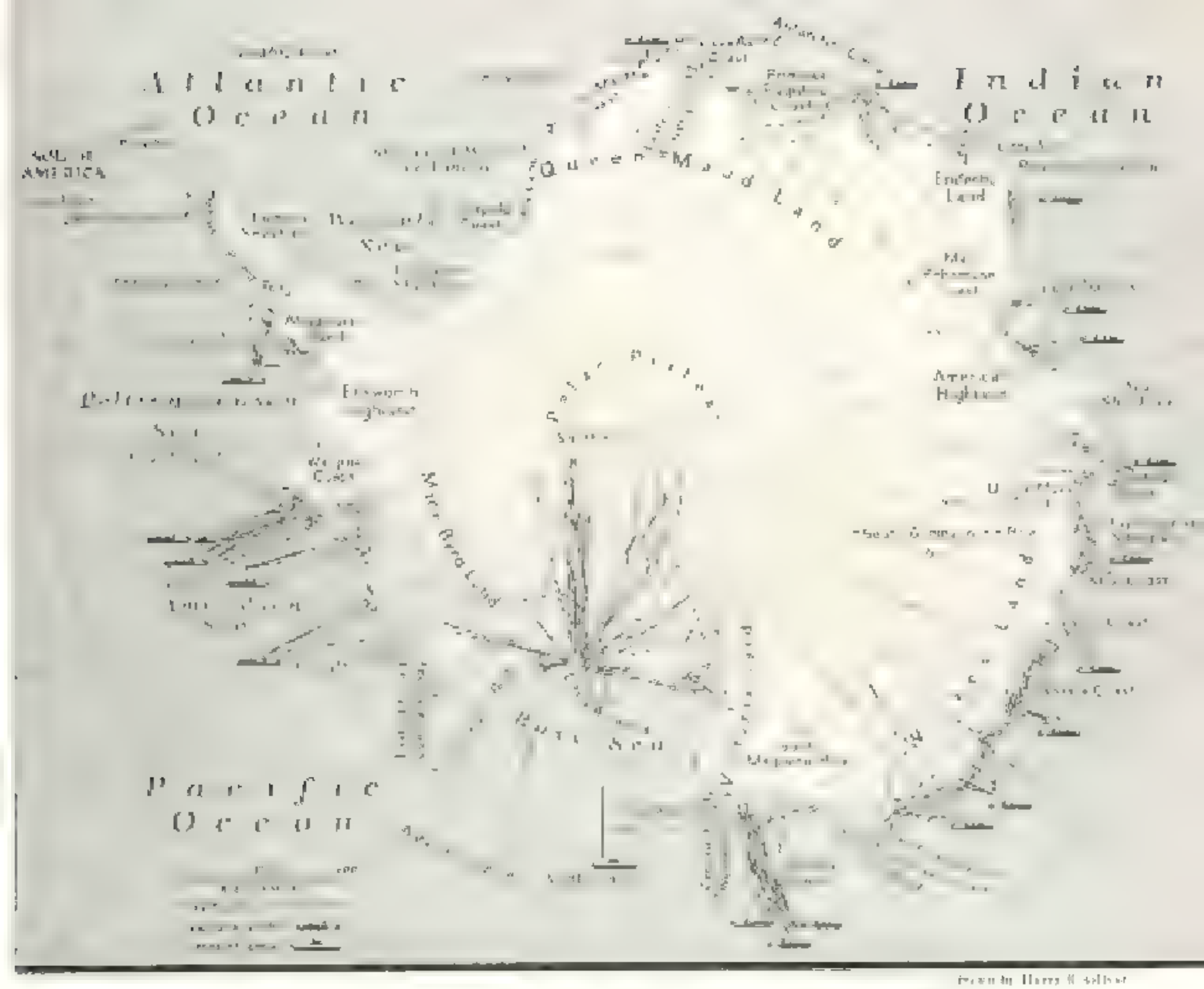
"Avenue of Frozen Rainbows"

Actually, I think, the way we traveled proved as breath-takingly beautiful a road through the skies as could be imagined. It might have been called the Avenue of Frozen Rainbows. The day remained cloudless. The sun, into which we had flown at midnight on our way south, now had moved around the heavens so that it faced us on our way north.

To east and west towered great mountains. Some were free of ice—coal-black and brick-red. Others were completely ice-covered. These looked like titanic waterfalls. Where the sun struck their peaks and slopes the light was reflected from them in an indescribable complex of colors. There were blends of blues, purples, and greens such as man seldom has seen before.

When we left the high plateau behind, it was a great relief to descend to a lower altitude. It is spending many hours at high altitudes in bitter temperatures that makes anoxia [illegible]

* This was an approximation at the time.



Flight Tracks of the Expedition's Exploring and Mapping Planes

[illegible] the Greenback made on [illegible] Aug. 7 and 9[illegible]

We were back at our base shortly before noon, having covered more than 1,800 land miles in a little more than 12 hours. The pilot lowered the landing gear. Just as the tents of Little America, like ink dots on a white sheet, appeared ahead and we let down for a landing, the photographer rushed up to me and shouted, "Hold tight for a crash landing. The right ski is gone."

I looked out the window. The stabilizer holding the right ski horizontal had broken, possibly from crystallization of the metal from intense cold and vibration. But, very luckily, McCoy some days before had rigged a cable to keep the front end of the ski from dipping too far forward in just such an event.

"Fine ending for a good flight," I said to myself as Anderson made a perfect landing.

The "hump" in the plateau, the marked rise in altitude which reaches its maximum about 150 miles north of the Pole in the direction of the Ross Shelf and which was noted on our flight, also was pronounced in the altimeter readings from two other flights which entered the continent through the gateway of the Wade Glacier but turned southwestward instead of following a direct southerly course.

At approximately latitude 87 and 115 east longitude their instruments indicated that the white surface below was about 10,500 feet above sea level.

Here again the recorded rise had been gradual. No irregularity was observable in the surface of the snow. It would seem to be a great ridge miles broad, about 10,500 feet high, and at least 200 miles long.

Frozen Torrents Pour Through Passes

On these southwesterly flights also it was possible to make more detailed observations of the Wade Glacier, named for a distinguished explorer, my old friend and associate Dr. F. Alton Wade, senior scientist of our last expedition. It now appears to be a frozen river system with four or five large ice streams pouring into it through high mountain passes from

various points on the plateau (page 470).

Almost at the mouth there are two small tributaries, and about 20 miles "upstream" the Wade is joined by another frozen torrent which pours down through the Prince Olav Mountains to the east through sheer walls of ice and appears to ascend as far as the surface of the plateau.

From 40 to 50 miles from the mouth there are two other large tributary glaciers which also seem to come from the plateau through 10,000-foot-high mountains to the west. The manner in which these rivers of ice flow together and amalgamate like rivers of water into one gigantic stream will be a fascinating problem for future expeditions.

The mountains grow steadily higher from the low, black hills on either side of the Wade, where it flows into the ice shelf, to the dark gray, brown, and red peaks towering into the sky at the top. Most of the mountains are sharp-peaked and steep-sided. A few, however, have curiously flattened tops. Some mountains are completely bare. Others are dome-shaped and covered with snow and ice.

There appears to be no easy explanation for this. Sometimes an ice-free mountain looms a thousand feet or more above a lower crest a few miles away on which not a single patch of bare rock is discernible. Thus temperature and altitude appear not to be the deciding factors in the phenomenon.

"Like a Gigantic Coal Pile"

The blackness of some mountains impressed the observers. They stood like masses of onyx among titanic crystals. One was described as "like a gigantic coal pile composed of loose black chunks scooped up by some glacier over a million years and left behind when the ice retreated." Some of them might possibly be mountains of coal. But actually coal exposed to weather over long periods tends to be brownish rather than black.

Both historically and geographically, the western shore of the Ross Sea from Cape Adare to the Heardmore Glacier was, before the establishment of Little America, the best known part of Antarctica.

This serrated coast, over which loom ice-covered mountain ranges through whose defiles wind blue and silver glaciers, first was skirted for 400 miles as far south as McMurdo Sound by Sir James Clark Ross with his two wooden ships, *Erebus* and *Terror*, in 1841.

Since then, McMurdo Sound has been the base of four British expeditions, two led by Capt. Robert Falcon Scott and two by Sir Ernest Shackleton. The coastline has been adequately mapped. British explorers have made long and perilous journeys up the glaciers.

The British and Australians have done magnificent work.

They have located and named the more prominent divisions of the west coast mountains—such as the Commonwealth, Queen Alexandra, Britannia, and Prince Albert ranges. They have placed on the map many individual peaks, such as cloud-piercing Mount Kirkpatrick, with an elevation of nearly three miles above sea level; Mount Harmsworth, which reaches 9,640 feet; and Mount Albert Markham, towering to 10,460 feet.

But these mountains along the coast formed a wall beyond which men could not go in the days of sailing ships and dog sledges. Explorers had no means of knowing what lay beyond the first ramparts of this mountain barrier, other than by glimpses from sea and shore of great peaks in the saffron-skied distance. They knew only that somewhere west of the mountains was the high plateau which Ross, who had sailed along its northern shore for about 100 miles, had named Victoria Land in honor of his then youthful queen.

The magnitude of the prospect was too great for its adequate grasping by earth-bound eyes of the explorers who had gone afoot up the Heardmore. Consequently, this expedition's air explorations brought a wealth of discoveries. They were, in fact, beyond our expectations. They are still more or less of a confusion in our minds until the trimetrogon photos can be analyzed.

Hitherto-unknown mountains are numbered in hundreds, glaciers in scores. For the first time, it can be stated confidently, one will be able to picture this complex of towering peaks as a whole, rather than in disconnected fragments.

The discoveries were made in a series of flights from February 14 to February 20. One of the most notable flights was that of a plane commanded by Commander Hawkes on February 20. It set out from Little America shortly after midnight on a clear, bitterly cold morning with a bright sun low in the sky.

Pilots Too Warm Where Heroes Froze

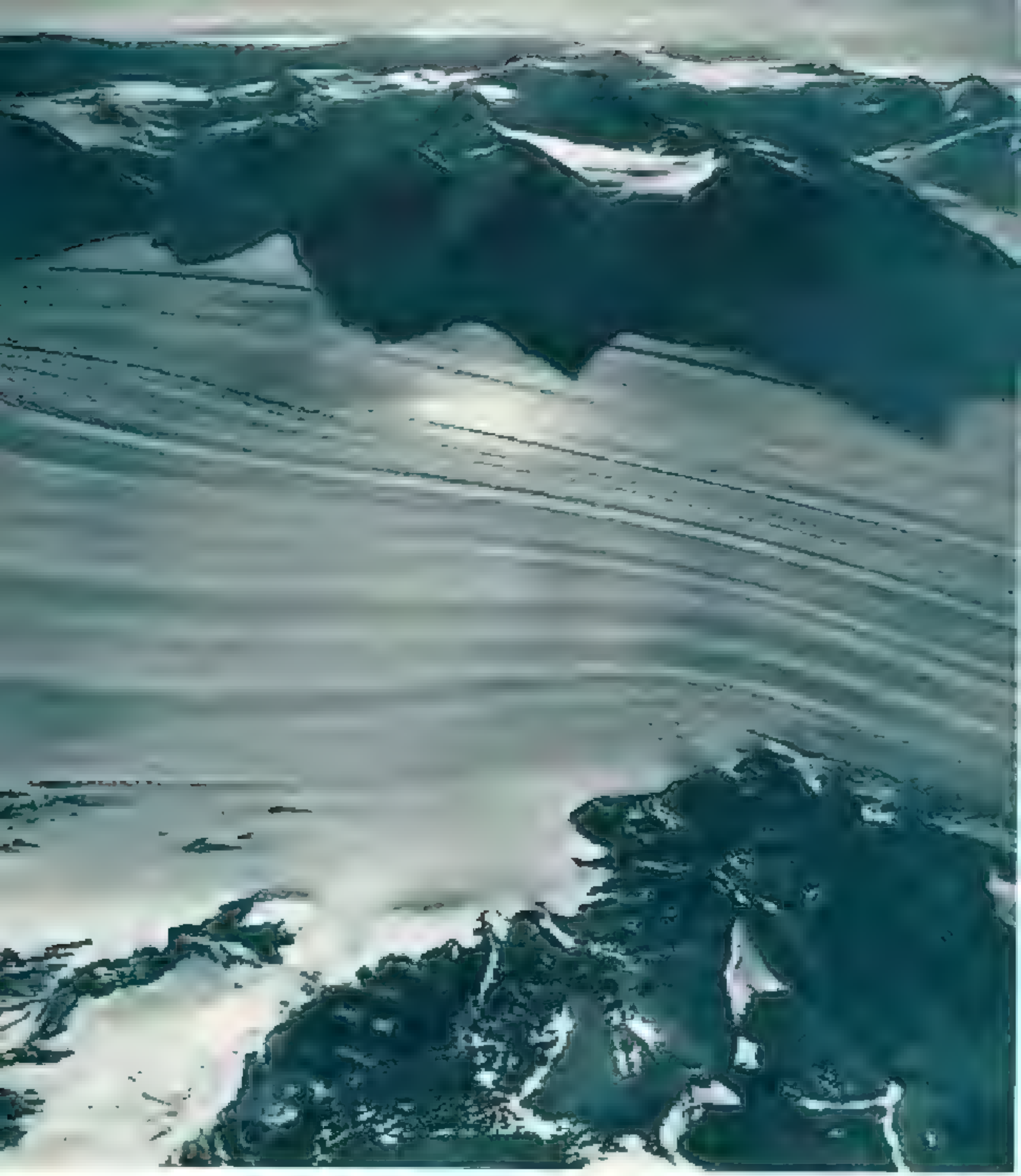
On our way westward across the shelf it became uncomfortably warm in the plane's cockpit. The heater was working this time. Lt. George H. Anderson opened a window.

"George," commented Hawkes philosophically, "do you realize that this is almost exactly above the spot where a lot of good men froze to death?"

He had kept a careful log since leaving the base and noted that the plane had reached

Mermaid Mandala of a Nameless Glacier Town in Southern Chile (Lunaria)

WHEN [illegible]



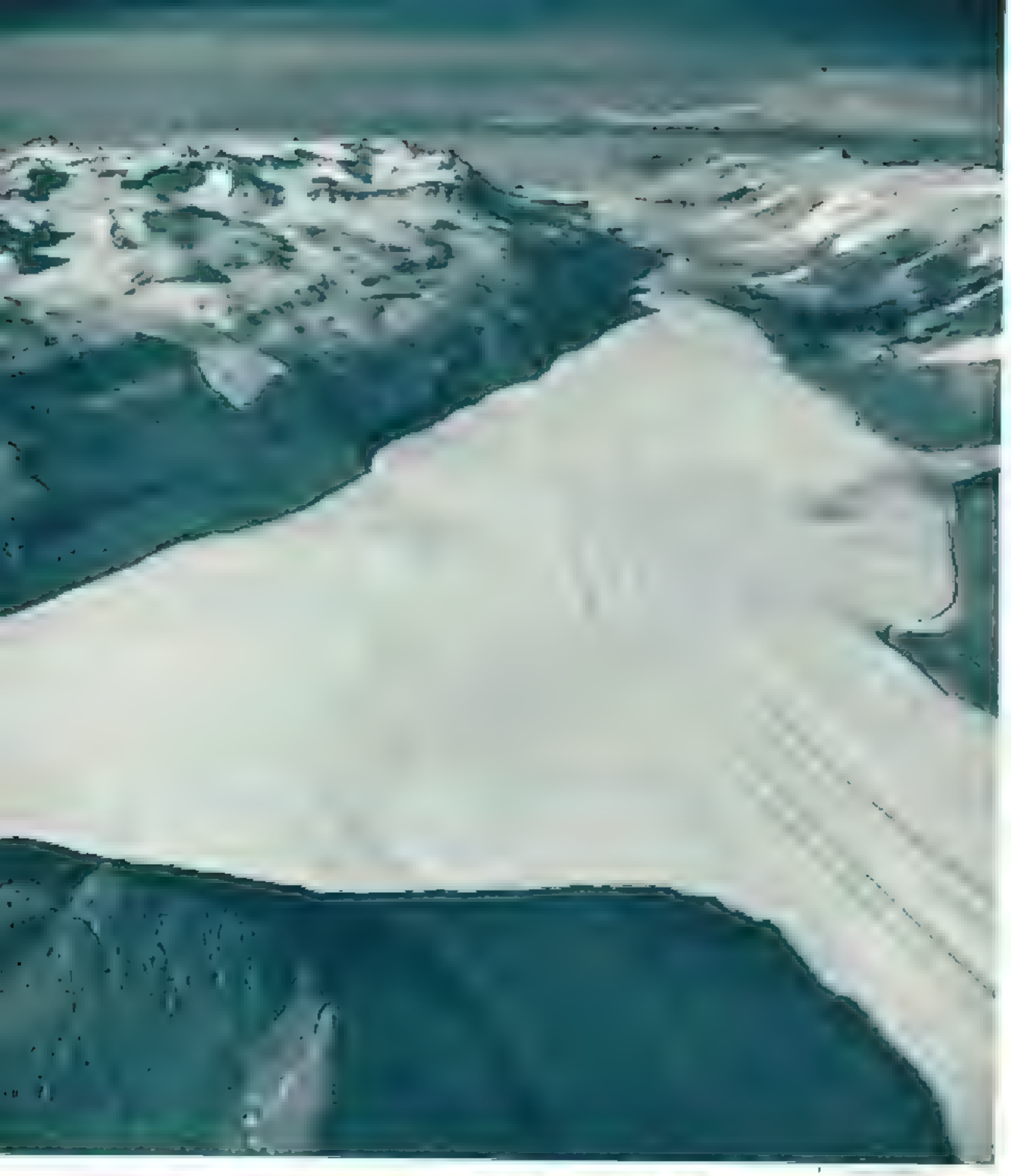
Through Sandway Mountains of Desolation Runs a Great Silver Ribbon

[illegible]

[illegible]

Edward Searles' Treacherous Rapids Toward the Peru Was Thus Dubbed Amazon

[illegible]



White Tresses Lick Out from Dark Mountains and One Dance Suspended in Air

Tremendous Ice Rivers from the Polar Plateau Near [illegible] Cross of Crevasses

HERE [illegible] glaciers, only [illegible] [illegible] is the dominant [illegible] responsible [illegible] is ice flowing [illegible] Mount Markham, [illegible] the west coast [illegible]

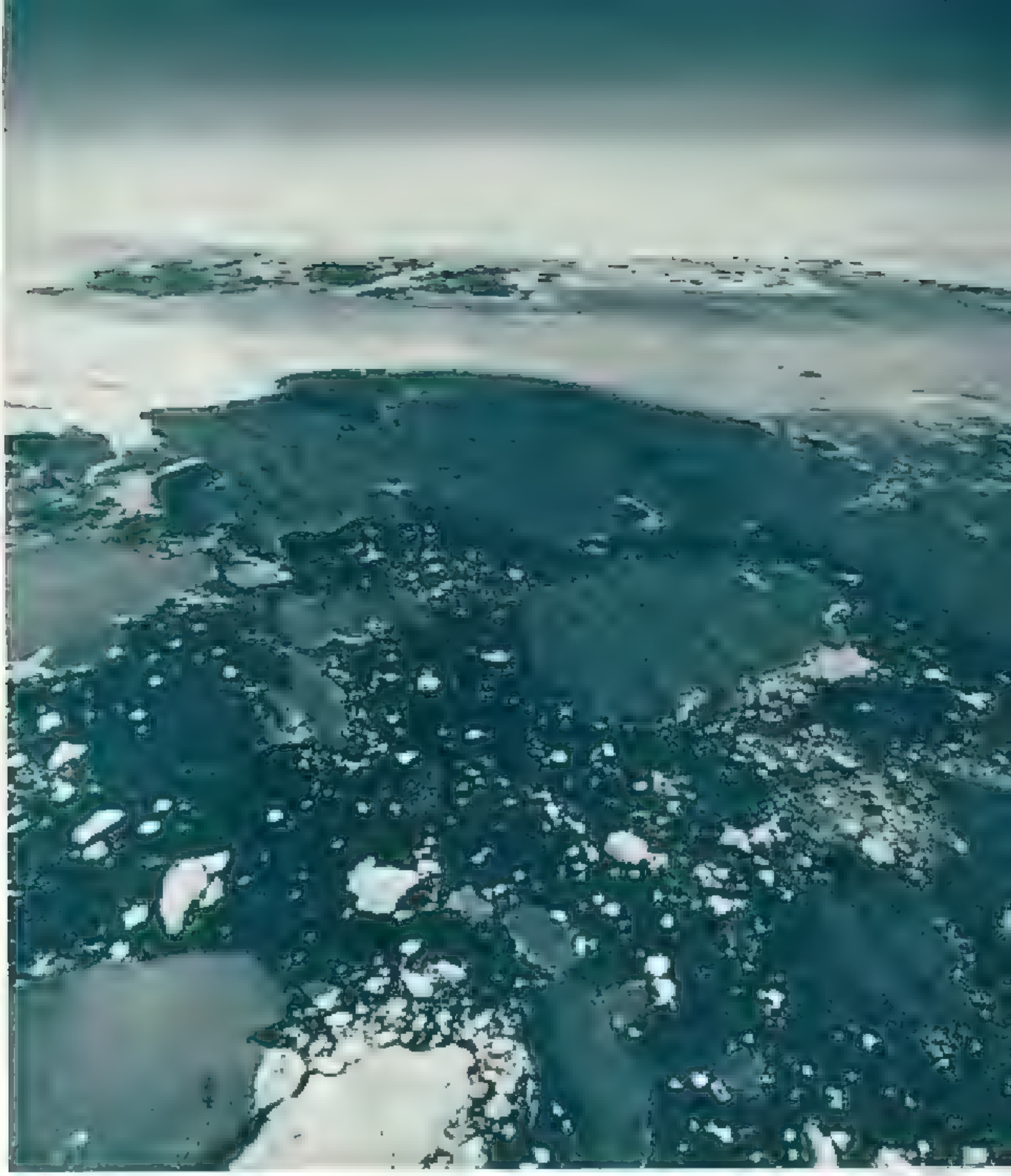
[illegible] is the largest [illegible] It probably empties into [illegible]

[illegible] Ross [illegible] thought to be [illegible] with [illegible] mouth was described by [illegible] Mapes ic mountains which [illegible] were photographed by the [illegible]

[illegible] the picture [illegible]

Grand Canyon Colors Glow at Mountainside Lace of Ice

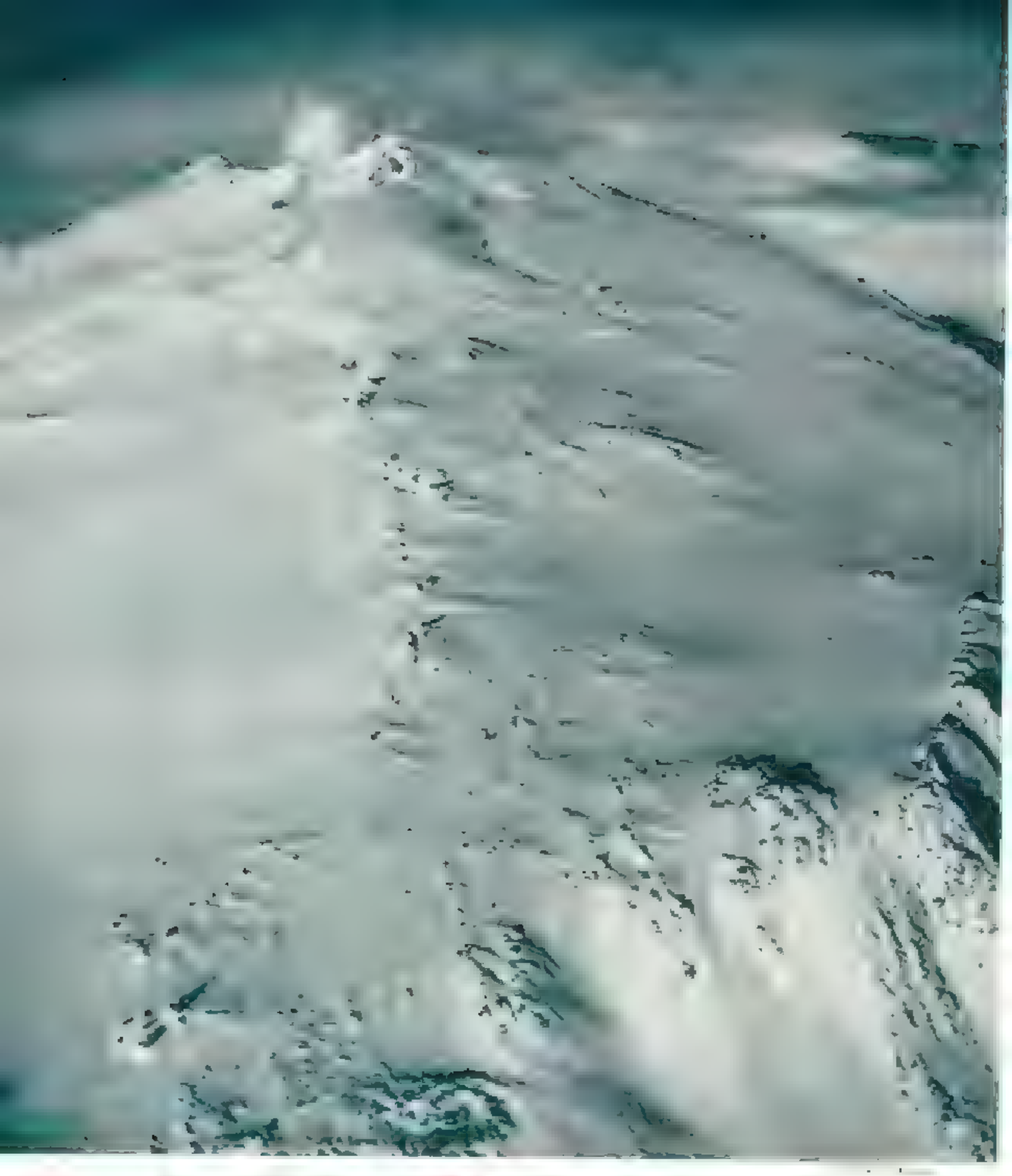
[illegible]



Air Force [illegible] Bombs a Water Spout in Hydrocarbon Antarctica

CONCLUSIONS [illegible]

[illegible]



Snow and Gases Pour from the Snowy Cone of Fiery Mount Erebus

AIRMEN flying [illegible] five volcanoes [illegible] [illegible]

[illegible]

Mount Erebus, on [illegible] of Mt. Melbourne [illegible] Mount [illegible] [illegible]

160°15' east and 79°38' south, where Scott's blizzard-defeated survivors returning from the Pole had come to the end of their tragic trail 35 years ago, almost within sight of a depot where they would have found food and shelter.

It was the most striking contrast imaginable between explorers of today and yesterday. It would have been difficult indeed for those despairing men to have imagined that within less than one man's lifetime an explorer would be uncomfortably hot where they had died of cold.

At this point, far in the distance loomed the peaks of the west coast mountains. The plane crossed the coastline at Cape Murray, about latitude 80, and also the coast range just south of the sharp-peaked Mount McClintock, which reaches 10,510 feet into the skies.

Weather had been threatening, but by rising above a low cloud cover it was possible to fly northward along the western ridge of the coast mountains.

Mile after mile they towered out of the white sea of clouds—an endless succession of mountain ranges seemingly suspended in the substratosphere. They were sheer pinnacles of ice and snow. They were cities of enchantment, steepled cathedrals, and glittering palaces of infinite cold where dwelt the monarchs of the dark vastnesses of space.

It was a scene out of space and time, as the mind knows these abstractions. Perhaps human eye never has looked upon a more awe-inspiring prospect than that which stretched below and beside Commander Hawkes and his crew.

These mountains constitute a belt from 50 to 75 miles wide extending westward from the Ross Sea coast. Beyond, as far as eye can see, is only the high, featureless desolation of the Victoria Land plateau.

Scores of Ice-free "Oases"

The wealth of new mountains discovered can only be catalogued for the present. Some striking features were noted by Commander Hawkes and his crew. There were, for example, a number of "oases"—valleys free of ice, in some of which are blue-green frozen lakes.

All are small, compared with the ice-free region several hundred square miles in area which had been discovered a few days before by Capt. Charles A. Bond near the coast 1,500 miles to the west (pages 475, 498, and 516, and Plate VIII).

These dry valleys, at least three of which are nearly ten miles long, show clearly on the trimetrogon photographs. They slope downward out of the mountains to the coast of the Ross Shelf Ice.

Their walls are steep slopes of brown rock over which icefalls hang suspended. These look like 1,000-foot-high waterfalls suddenly frozen in space before reaching the "oases" floors. The bottoms of the valleys, viewed through holes in the clouds, appear covered with hillocks of glacier-deposited gravel.

A somewhat similar ice-free corridor descends out of the mountains to the Ross Sea at New Harbor. This valley was explored by members of one of Scott's expeditions. It is about two miles wide and 20 miles long and is known to have once been occupied by a glacier. There is no evidence of any underground thermal activity.

Promising Base for Exploration

Most of the valleys of this sort photographed by Commander Hawkes seemed entirely isolated among low mountains. One aroused special interest. In its center is a small lake, entirely frozen over in mid-February, upon which an airplane could be landed easily.

Protruding out of the ice is a small island, a black mass of rock. This would provide an excellent "ground" for a radio station.

Thus explorers, including geologists, could be set down in the middle of one of the most forbidding regions on earth and conduct short foot or dog-sled expeditions into the surrounding mountains. All the time they could keep in constant touch with the outside world.

The presumption is that these valleys originally were cleared by the retreat of small glaciers. They probably are kept clear by strong prevailing winds which sweep away the snow as fast as it falls. The low hills of black rock which surround them absorb a great deal of heat during the three summer months of perpetual daylight. This is reradiated slowly.

Such a hypothesis might explain tentatively the hanging waterfalls. The rate of melting due to the radiated heat presumably is such that they never can quite reach the valley floors. From them through the summer would flow many small brooks to form the lakes in the valleys.

It was all a repeat of new "wonders of the world." One striking feature, for example, was a series of isolated mountains whose sides were stratified with rocks of various colors. They had the appearance of the walls of the Grand Canyon of the Colorado, but on an even more impressive scale. The stratification showed clearly, since the mountain walls were free of ice and vegetation (page 474).

Another such phenomenon was the "Titans' Honeycomb." This mysterious natural feature appears on the film now being studied as a plain of almost mathematically regular

Mittened Hands Make Fast a Hawser to a "Bergschrund" in the Ice

[illegible]

hexagons covering a large area of low, flat mountaintop.

[illegible] explanation was that it probably was a large field of dried mud, the cracks of the hexagons being formed by the [illegible]

The picture taken from more than [illegible] in the air was not dissimilar to that of a [illegible] treeless mud flat in midsummer. But it required a stretch of the imagination to [illegible] an Antarctic mountaintop actually [illegible] would at any time.

The final explanation must wait until [illegible] visits the place on foot. Experienced geologists now believe [illegible] River. If they were stripped of [illegible] Giant's Causeway on the [illegible]

The apparent explanation is [illegible] rock which rises from the depths of the earth very slowly, instead of [illegible] violently as in a volcanic eruption, and cools [illegible] through the years, the processes of erosion eat away the softer surface rocks overlying them.

In this case, he believes, the hexagons presumably represent the tops of the diabase columns. They are seams filled with snow so that they [illegible] photographs [illegible]

[illegible]

[illegible]

Beardmore and the Wade, and in some respects surpasses them in wild scenic beauty. I believe it is the largest glacier so far discovered (page 473).

This is a monster river of ice which flows at least 80 miles out of the 9,000-foot-high continental plateau of Victoria Land through gaps in the mountain ranges into the Ross Shelf. It left those who looked down upon it awestruck, and their impressions have been more than confirmed by the photographs.

Perhaps the most striking feature of this glacier is its "roller-coaster" appearance. There are considerable stretches of its surface with rolling drops of 100 feet or more within a few feet of horizontal distance. They are like the great ocean swells that precede a typhoon.

One can hardly imagine the picture, in untold years to come, when the icecap melts and this glacier presumably will be a river of water—mile after mile after mile of perpetually thundering waterfalls through 10,000-foot-high mountains. For breath taking savage sublimity it should be one of Nature's masterpieces.

The precise point where the great ice river empties into the Ross Shelf remains to be calculated from study of the photographs taken from the air, together with photos made by members of Sir Ernest Shackleton's party of 39 years ago. A possible outlet appears to be Shackleton Inlet, which cuts into the land at about 82 22 south.

"Curiosity Not Unmingled with Awe"

Shackleton* had predicted that a small glacier of low gradient would be found emptying into this inlet. It is interesting to recall his own observations at this point, prophetic as they are of the discoveries made by Commander Hawkes and his crew. In his account of his first expedition he writes:

"Up the inlet lies a great chain of mountains, and far into the west appear more peaks . .

"It falls to the lot of few men to view land not previously seen by human eyes, and it was with feelings of keen curiosity, not unmingled with awe, that we watched the new mountains rise from the great unknown that lay ahead of us. Mighty peaks they were, the eternal snows at their bases, and their rough-hewn forms rising high towards the sky. . . . As the days wore on, and mountain after mountain came into view, grimly majestic, the consciousness of our insignificance seemed to grow upon us."*

* From *The Heart of the Antarctic*, by E. H. Shackleton, published in 1909 by William Heinemann, Ltd., London.

Thus one of the greatest explorers of all time was impressed by the distant prospect of the wildness and majesty which Hawkes and his crew were the first of living men to see as a whole.

They looked directly down on hundreds of square miles of these glaciers, valleys, and mountains. Five miles above the clouds they flew beside mighty mountain walls over which glaciers hung suspended like silver ribbons.

Throughout the flight over the mountains there was a succession of ice-covered green lakes in the valleys. They appeared through rifts in the foamlike ocean of clouds below the plane and looked like emeralds in the diamond setting of the glittering névé which covered the surrounding peaks.

Colors of these lakes ranged from the green of new grass in a northern springtime to a strange purplish green.

Most of the lakes were small; presumably they would be typical tarns in northern mountains. But one was nearly three miles long. They usually are found in broad valleys among relatively low hills through whose interstices sweep high winds.

These keep the valley floor clear of snow. There is no opportunity for the compaction of the niv é year after year, the process which results elsewhere in the building of the great ice sheet which covers the continent.

Slopes of many of the surrounding hills also are ice-free. Black and red rocks forming the northern walls of the valleys absorb and then reradiate the heat waves of the 24-hour long sunshine of summer days.

Presumably small streams trickle into the valley floors where they form pools which freeze early in the Antarctic autumn. Thus are created the small lakes which are among the most striking features of Antarctic mountain scenery in the more northerly latitudes.

Fiery Mountain in Antarctic Ice

Just before returning to Little America from this mission, Commander Hawkes had planned to fly over the crater of Mount Erebus to photograph its interior. When he arrived however enormous volumes of vapor were pouring forth and being blown eastward and northward by a high wind. The great volcano apparently is approaching a period of increased activity.

It would have been highly perilous to carry out the plan—nobody knows what poisonous gases might be contained in the smoke from the earth's interior—and photographs would have revealed nothing. It was possible only to skirt close to the western edge of the 13,200-foot high summit (page 476).

Bashing for Antarctica. Through Thin, "Rotten" Ice in the Ross Sea the Expedition's Ships Drive Steadily for Their Goal

Marines Test an Amphibious Tractor in the Bay of Wrales

[illegible]

Descending the Mere's Geographic, Admiral Byrd Crosses a Tumbled Island

[illegible]

The steaming mountain easily dominates the whole McMurdo Sound area.

Two planes, one piloted by Lt. George W. Warden, accompanied by Ensign Stanley J. Andrews, and the other by Lt. Robert J. McCarthy, came off the Polar Plateau down the Beardmore Glacier. They had flown inland for about 300 miles by way of the Wave.

The Beardmore extends about 100 miles through a 14-mile-wide corridor from the plateau at the 85th parallel, where the elevation is slightly above 7,000 feet, to the Ross Shelf, whose surface is slightly more than 200 feet above sea level.

This Amazon of ice was discovered and first ascended by Sir Ernest Shackleton during the polar summer of 1908 on his first attempt to reach the South Pole. Three years later it was the road chosen by Captain Scott for his epic and tragic polar venture. It is a series of rough torrents of blue ice (page 471).

On the west rise precipitously the ice-covered peaks of the Queen Alexandra Range, the highest of which, Mount Kirkpatrick, reaches an elevation determined by triangulation as approximately 14,600 feet.

The eastern wall is formed by the lower, but even more rugged, Commonwealth Range.

Flanking the glacier on the southeast, but apparently extending by no means so far east as is represented on existing maps, is the 10,000-foot-high Dominion Range.

A dozen or more tributary glaciers flow out of the mountains into the Beardmore. Between the icefalls are long stretches of crevasses which were crossed with extreme difficulty and peril by the British explorers.

Man Stunned by His Own Littleness

Both Shackleton and Scott were men of poetic imagination. Words failed them when they tried to describe the sublimity of this great highway of ice; words always will fail to convey to others the grandeur and the glory of the Beardmore. They traversed it slowly and perilously on foot, like white ants crawling through the long shadows of the gigantic mountains.

Perhaps nowhere else on earth is man so stunned at the realization of his own littleness before the majesty and the power of Nature. On the blue floor of the Beardmore, as nowhere else, comes the full realization of Mrs. Browning's lines:

> . . God's greatness
> Flows around our incompleteness—
> Round our restlessness, His rest.

Shackleton and Scott were more men looking upward. They surveyed the mountain peaks as philosophical and scientifically minded men might survey the towered buildings of Wall Street as they crawled along the curb. Lieutenant Warden and his crew surveyed them as might tiny wrens flying above. They got a more complete picture, but there was the same sense of human futility.

The glacier is formed by the merger of two large branches which flow in from the plateau, whose ice appears to be quite turbulent in this region. It apparently covers an extremely rough country, with numerous small peaks protruding above the great, flat white-ness.

At the southern end, approximately between these two streams, is a striking feature not hitherto reported—a relatively flat and almost completely ice-free area of about five square miles which protrudes about 2,000 feet above the névé.

It is dark red in color and absolutely barren—a red desert in the middle of a white desert. Its surface has an elevation of more than 9,000 feet above sea level and appears to be the top of an enormous mountain whose crest may have been planed down at some time. The surface is rough.

Ice Cataracts amid Red Peaks

Here again is a phenomenon for which there is no plausible explanation. The falling snow may be swept away constantly by prevailing winds, so that no ice can form, or there may be some subterranean heat source.

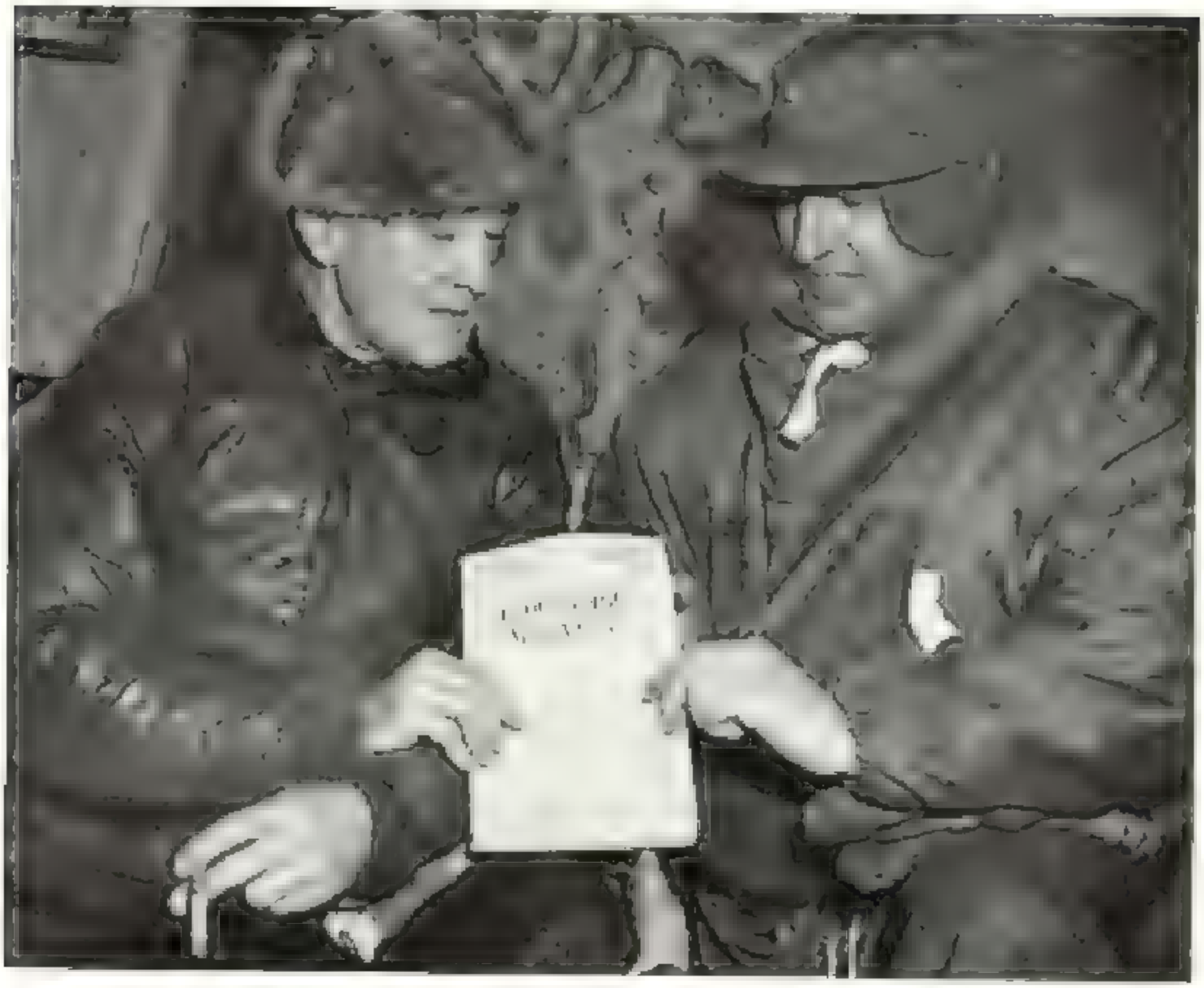
Frequently there is a depression over which ice spills from the glacier sides, forming lovely frozen cataracts. At one point is a small ice-covered lake.

The two planes flew down the glacier, one on the west and the other on the east, between 10 and 11 p. m., Little America time. Directly behind them, halfway up the southern horizon, was a bright sun which fell on the glittering mountain walls ahead.

A striking sight in the direct sunlight were the stratified rocks with alternating bands of dark maroon and rust red. The photos show several of the smaller glaciers flowing into the Beardmore, as well as ice Niagaras falling over the mountainsides. Near the source the crevasses are breath-taking. They grow smaller and smaller as one approaches the mouth, until the barrier ice is reached.

The great wall of the Queen Mauds stands between the southeastern extremity of the Ross Shelf Ice and the plateau.

At least ten glaciers flow through the high passes of this series of mountain ranges—mighty frozen rivers dropping at least 8,000 feet within 90 or 100 miles from the great ice-cap into the solid sea.



After 12 Years in Little America, This Magazine Was as Good as New

[illegible]

[illegible] the [illegible] [illegible] [illegible] the Scott and the [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] with the [illegible] [illegible]

[illegible] [illegible] [illegible] barrier against [illegible] [illegible] to penetrate the continent from this direction. Although the [illegible] have been photographed and recorded [illegible] [illegible] unexplored.

One flight, with Major Weir of the Marine Corps, [illegible] [illegible] Little America [illegible] [illegible] across the [illegible] headed for the [illegible] [illegible] the Queen Maud Range. We expected to cross the [illegible] of the [illegible] Escarpment to find out what [illegible] on the South American side of the South Pole. It was our first [illegible] into unknown areas.

'Hourglass Glacier' Discovered

After passing the 83d parallel at [illegible] we had [illegible] country [illegible] finally we sighted mountains [illegible] Many of them were covered with ice, and Major Weir and I [illegible] [illegible] the [illegible] of [illegible] our [illegible] the weather where we could land.

Gleaming Ice Crystals Adorn a Ceiling in Long-abandoned Little America

[illegible] Nature's handiwork transformed the old barracks into [illegible] 441-2). This was the short Little [illegible] to be [illegible]

The mountains were strung out as far as [illegible] and [illegible] to right and left.

On the starboard bow we [illegible] which was free of clouds and appeared to be the best approach to the [illegible] We decided to use [illegible] and also aimed to be the Scott.

We knew it was possible that we might be well off our course to the westward and that the glacier was the Scott.

We had with us some photographs of the mountains at the portals of the Scott Glacier and some foothills thereabouts. As we approached, we could not check any of the mountains with our photographs. We began to doubt then that this was the Scott Glacier. If not, then it was a great new one, in which case we probably [illegible] our course to the left instead of to the right.

We later found out that this glacier was approximately 60 miles east of the Scott, and it therefore constituted a major discovery.

At its mouth the glacier appeared to be about 15 miles wide (distances judged from an airplane, of course, must be approximate), but it narrowed rapidly to a width of only three or four miles about [illegible] glacier; then it broadened [illegible] approached the plateau until it [illegible] about a 15-mile width. The [illegible] ingly like that of an hourglass.

New Mountains Every Few Minutes

[illegible] interesting [illegible] plane approached it at an altitude of [illegible] about 2,000 feet above the surface. In order to do this, so steep was the slope of the glacier river, we had to rise to 11,200 feet.

Looming over the western side of the glacier all the way was lofty mountain after lofty mountain. Many of these peaks were more than 10,000 feet above sea level.

These mountains I believe to be a continuation of the Watson Escarpment, discovered on my 1933-35 expedition and named by me after my friend, the distinguished American, Thomas J. Watson. On the eastern side of the glacier the mountains were lower, not exceeding 4,000 to 5,000 feet.

Often we found ourselves flying alongside the western range, so that we saw the mountain walls directly in front of our eyes when we looked out the window. These often were close aboard.

The surface of this new glacier was like a silver washboard, but there were none of the great rises and drops noted along most of the other ice rivers.

Most striking of all was the fact that there appeared to be no very badly crevassed areas, either at the source or at the mouth. No tributary streams were noted. This may prove of considerable significance when some future expedition seeks a road for the tractor march to the South Pole.

Once through the glacier we found it advisable, because of clouds to the right and ahead, to turn eastward instead of flying south over the plateau.

At that point we made an interesting discovery. We could see high mountains ahead as far as the eye could reach. There were clouds here and there, but our range of visibility was considerable. Some of the mountains were very high.

This indicated that the great range of mountains we had to cross to get to the Pole continued on indefinitely to the eastward and did not disappear as I had thought, or suspected, it might far south, as has been thought by many.

I suspected that some mountains I dimly saw to the southeastward might be a great new range.

This is the sort of situation out of which I get the greatest kick: flying over completely unknown areas with magnificent topographical features coming into view every few minutes of the flight.

Oil-pressure Drop Threatens Forced Landing

As we continued to the eastward, I saw mountains of all shapes and sizes on the port hand and ahead, many of them a long distance away. The temperature had dropped to about 35° below zero.

Since this was the kind of experience that more than anything else draws me again and again to the Antarctic, I was greatly disappointed when Major Weir told me that the oil pressure in the starboard engine was dropping rapidly. But my feeling was not only one of disappointment. A forced landing in that area would have been a bit unpleasant.

There was only one thing to do—get back down the glacier as soon as possible, hoping that the engine would hold out until we could reach lower and much warmer temperatures, and that when we did get there we would find that it had been the cold that had caused the pressure to drop and not some other trouble that would force us to crash-land.

Mariners are notable for their courage, and these flyers with me had distinguished themselves in the war. But this situation was something entirely new to them. Since it was the R4D unit's first flight into the unknown, it was a sort of baptism.

These gallant officers, who felt at home fighting the Japs, in effect found themselves suddenly precipitated into a scene of infinite grandeur that can be observed only in an area in the clutches of a full-grown ice age.

Flyers Awed by Mountains' Immensity

For some reason I have never been able to understand, when gazing upon the great mountains that rim the Polar Plateau one gets the impression of such immensity that one feels like a tiny and infinitely insignificant speck in the vastness.

Perhaps it's the amazing visibility one gets down there where there is no dust. Possibly it's the grandeur of the terrain or some quality that is peculiar to an ice age.

At any rate, feeling like an infinitely insignificant speck in eternity does not add to any feeling of coziness one may have.

A forced landing in an ordinary mountainous area was one thing, but this was another proposition altogether. I admit that, sixteen though I was, I probably felt just as uncomfortable as they did. But I could not help but feel a friendly amusement at the awestruck faces of my companions.

I could almost hear their thoughts as they were undoubtedly asking themselves, "How in heaven's name did I ever get into this place?" And while the photographer was taking a photograph I heard him mutter to himself something that sounded like "Jeepers!"

Needless to say, we didn't lose any time getting down that glacier. Luckily, the engine held out, and as we descended into the less cold strata of air the oil pressure began to pick up again.

When we got down to the foot of the glacier, the co-pilot, without any orders, automatically started in the general direction of Little America. He didn't know exactly where it was, but he certainly had a wonderful homing instinct.

When we asked him where he was going, he said, "Back to Little America, of course. This crea and this engine don't fit together, and I'm sorry the war is over."

However, in a little while the engine appeared to be O. K.; so we headed eastward, and soon we were exploring virgin area every mile of the way.

Beneath us was [illegible] shelf ice [illegible] covered with [illegible]. As we continued eastward, great block-shaped mountains that were quite isolated came into view. Some of them were very high, but were covered with clouds, and we could not estimate their altitude.

An Important Geographic Problem

The great mountain range continued on in a direction south of east, and after flying about 70 miles I had the impression that this range might continue for hundreds of miles.

If the great analogy was such [illegible], it would not be impossible for it to continue until it connected with the Weddell Sea, which would mean there are two continents at the bottom of the world instead of one.

To determine whether or not this sea connection exists is one of the most important exploration problems left in the world to be solved. I made the solution of this problem, and not the flight beyond the Pole, the first objective of the expedition.

During our 10-hour stay at Little America we sent flight after flight out in that direction, and, though many major discoveries were made, we still have not got the answer.

On my other expeditions we attempted again and again to solve this problem, only to be baffled by the thick weather that exists in that area. The great question is, Was there shelf ice under us, as it appeared to be, and did it extend on to the Weddell Sea? Or was low land under the snow?

Clinging Tightly, a Photographer Is Hauled Up from a Mid-ice Crevasse

Depths of these natural mantraps vary. It seems appear to be bottomless. Lieut. Cdr. H. H. Arnold, Marine Corps, photographer, descended with the aid of the knotted rope to take pictures deep in this crystal abyssal. In such lairs the Weddell seals during the bitter cold Antarctic night. These peculiar calls have been heard from far beneath the surface (pages 501 and 51).

Jato Bottles Boost a Plane into the Air from the Ice Strip at Little America

[illegible]

Mechanized Attack on Antwerp: 16-ton Amphibious Tractors Carried the Flag Inland to the Roaketts-les-Montrains

[illegible]

With Pressed Steel Planking and Snow, a Causeway Is Bridged to the Place Cap Cross

[illegible]

We will keep at this problem until we get an answer. Perhaps the American expedition now in the Palmer Peninsula area, south of South America, may get an answer before it returns to the United States next winter.

Two missions went to within about 250 miles of the Pole. On one of these, commanded by Lieutenant Anderson, was discovered a very high mountain range which branches southeastward from the eastern end of the Queen Maud's. It appears to be a continuous series of ice-covered peaks extending for at least 200 miles. These may have been the mountains we saw clearly on the flight just described.

This flight passed through a saddle-shaped area between the Queen Mauds and the Horlick Mountains, which extend to the eastward. Below the airplane were round-topped hills with an average elevation between 9,000 and 10,000 feet above sea level.

Once through this depression, Lieutenant Anderson was forced to go higher and higher, and he never got out of the high mountain area before turning around for the return flight to Little America at a furthest south of latitude 86 40.

The plane flew at an altitude of about 13,500 feet above soft, feathery clouds. Through these protruded the crystal mountaintops. Several appeared to be about 15,000 feet high, towering far over the aircraft. There were many with elevations of at least 12,000 feet.

The largest of the peaks rose above the clouds with somewhat the appearance of a vanilla ice-cream cone. The sheer, red sides of the mountains seen below the clouds were ice-free.

"Seeing Pink" Is a Danger Sign

All the way from Little America the plane was pushed by a strong tail wind. An early turned back when crew members complained of "seeing pink," a warning symptom of the dreaded anoxia from the long-continued altitude of nearly three miles without oxygen equipment.

Over the mountains it had been necessary to keep well above the clouds, and it was never possible to get out of the mountains and over the level plateau country.

This flight indicated that there may be a break between the Queen Mauds and the Horlicks. They may even belong to entirely different mountain systems in spite of the connecting chain of low crests in the "saddle." It also suggests the hypothesis that the main chain of the Queen Maud ranges themselves turns rather abruptly across the continent. It will be interesting to determine whether or not they extend as far as the Weddell Sea on the South Atlantic side.

Our flight crews were the first human beings ever to look on the greater part of this chaotic region. They discovered several new mountain ranges.

The precise locations of these and their relationships to each other remain for geographers to determine after a study of the hundreds of photographs. Perhaps data from future expeditions will be necessary before there is a satisfactorily clear picture.

A mission piloted by Captain McIntyre, of the Marine Corps, came over the continent about 50 miles east of the "saddle" through which Lieutenant Anderson's plane had passed. It flew inland for 500 miles without seeing a single peak protruding from the low clouds over the level surface.

At the end of this route black crests began to appear to the south and west, all so obscured by the clouds that the photographs obtained are very difficult to interpret. This mission turned westward and came back over the Horlicks.

Through a Canyon above the Clouds

Low cloud cover also hampered a mission piloted by Lt. Conrad S. Shinn which crossed the continental shore line still further to the east. This flight, however, encountered mountains almost from the start, and it was at least an hour, flying at an altitude of 13,500 feet without oxygen on one of the coldest days in February, before the plane was over the level surface of the plateau with no mountains ahead.

When the clouds cleared temporarily, the crew saw below them one very large range. The colors of the barren peaks ranged from dark brown to dark red. Shinn describes them as having an "ashy look," and feels that they are of volcanic origin.

This flight encountered several striking natural features. For about 20 miles the plane flew through a "canyon above the clouds," with sheer, towering rock walls about eight miles apart on both sides. Just south of this it passed over a great strange valley, whose floor was paved with black, rounded, ice-free hillocks from 15 to 40 feet high.

On a two-plane flight just south of the coastline of the Ross Shelf Ice, a most straight east from Little America, one plane passed over most of the country designated on maps as occupied by the Executive Committee Range.

The trend of this range, hitherto sighted only from a distance, was more south-southeast than had been assumed.

On this flight with Dr. Siple [illegible] planes, [illegible] photographs of the [illegible] [illegible] southern [illegible] [illegible] 20,000 feet high.

[illegible]

Seaplanes Map a Phantom Coast

[illegible] squadrons were doing their share of exploring.

The Western Group, commanded by Capt. Charles A. Bond, consisted of the seaplane tender Currituck, the tanker Cacapon, and the destroyer Henderson. These ships [illegible] northward [illegible] the Balleny Islands [illegible] [illegible] the Antarctic Circle.

[illegible] Wilkes Land [illegible] toward the South Pole.

Parts of this coast were sighted almost simultaneously 107 years ago by Lt. Charles Wilkes of the American Navy and the French explorer Dumont d'Urville.* On January 19, 1840, all three of Wilkes' vessels, the *Vincennes*, *Peacock*, and *Porpoise*, reported [illegible] partially [illegible] peaks [illegible] clouds, at approximately [illegible] feet.

These observations [illegible] generally recognized [illegible] the discovery of the Antarctic Continent.

Ever since [illegible] [illegible] only [illegible] [illegible].

[illegible] Only fragments of the coast for about 1,500 miles [illegible] Islands had been charted [illegible] this year [illegible]

End of a History-making Flight from the Carrier *Philippine Sea*

[illegible]

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* See "Wilkes and d'Urville's Discoveries in Wilkes Land," [illegible] National Geographic Magazine, [illegible]

In a Snowy World that Freezes to Wheels, Both Men and Horses Wore Skis

[illegible]

Harvesting Seals Caught in Icy Waters by Dent Giddy-resistant Swimming Suits

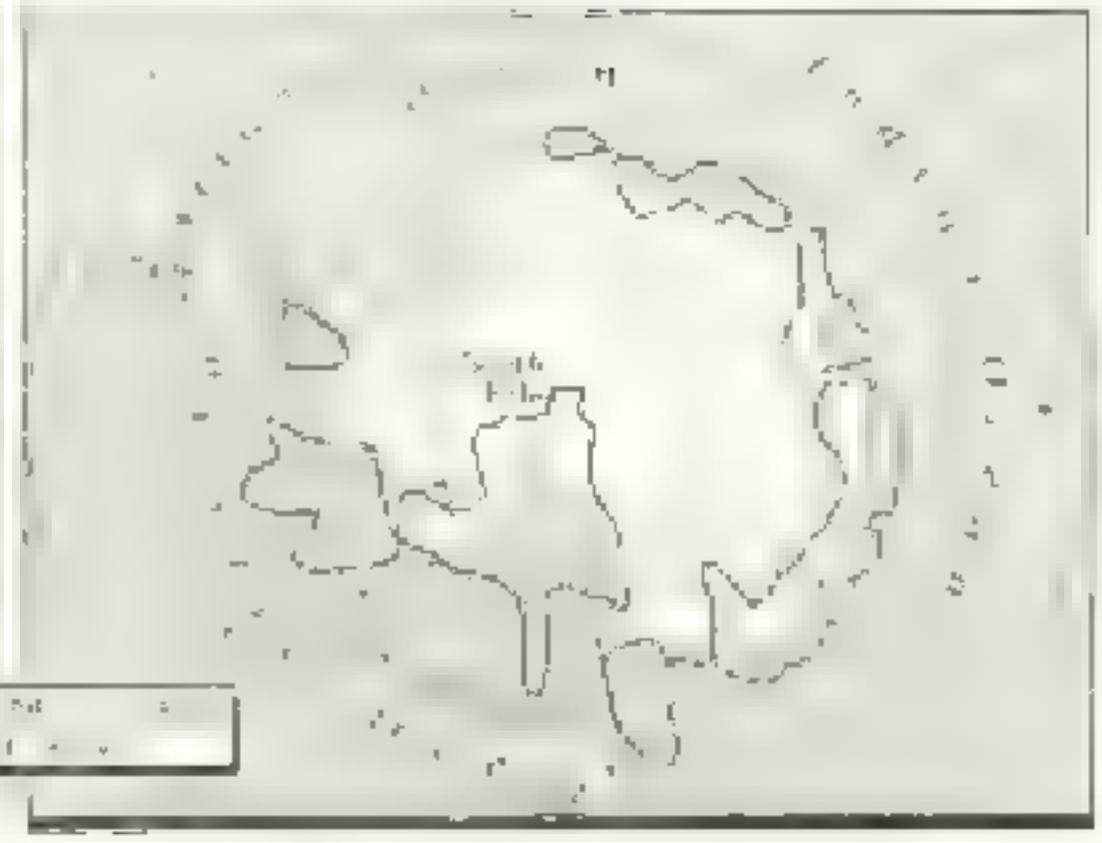
[illegible]

Hot Summer Day's Dream! Smiling, He Swims in Icy Antarctica

[illegible] Whales. This sal[illegible]

Antarctica Compared to the United States

Maps drawn on the same equal area scale emphasize the extent of the southern continent. Here the South Pole is at the center with Tulsa, Oklahoma.



Areas Mapped by the Expedition's Planes

Mapping cameras covered most of the coastline and made deep dents in the largest unexplored area on earth, even penetrating beyond the Pole.

to demonstrate, these maps had little relation to reality. They had been patched from scattered observations, mostly from north of the ice pack, over the course of a century. Before Captain Ford and his pilots stretched a bleak, white unmapped immensity of blizzard filled unknown.

Essentially the only systematic explorations here had been those of the Australian, Sir Douglas Mawson. But he did such magnificent work, not only in the field of geography but in other branches of science, that he easily qualifies as one of the greatest polar explorers of all time. His scientific data are probably superior to any that have come out of the Antarctic.

Winds Raise "Flying Rivers" of Snow

Commonwealth Bay, where Mawson once established a camp, is probably the windiest region on earth. It is the coast of "flying rivers," a phenomenon peculiar to Antarctica.

The air above the South Pole settles over the ice-capped high plateau and becomes cooled. This cold air flows down over the mountain passes and through the valleys, attaining hurricane velocities.

These winds raise huge whirlpools of snow to altitudes as high as 1,000 feet. These are blown northward at from 80 to 90 miles an hour. The result is a tumultuous "snow torrent in the sky" which finally descends over the pack ice and the ocean.

In this region, with their Martin Mariner flying boats (PBM's), the crews started transforming a panorama of mirages into a reality of solid ice and rock.

The first exploratory flights were along the Oates Coast, originally discovered by Lt. Harry L. L. Pennell, of the British Navy, who was a member of Scott's 1911 expedition. It bears the name of Capt. Lawrence E. G. ("Titus") Oates, one of those who perished with the commander on the return march from the Pole.

Because of the thick ice pack, Pennell was unable to approach the coast closer than 14 miles. Mist and clouds obscured the landscape ahead. This apparently is the usual condition. Only a thin fringe of coast is marked on maps.

The air photographs showed—as they were to show so frequently in the future—that the actual coastline had very little resemblance to that assumed by map makers.

Rennick Bay became a deep triangle of ice-covered water extending about 100 miles into the land, with its western side constituting the hypotenuse. Both sides are bordered by mountains reaching altitudes of 8,000 feet above sea level.

The net result was that the feeble, wavering Oates Coast became almost in its entirety a mountain-enclosed bay. The whole region was fog-covered, and photographs do not show much detail.

Just outside and slightly to the west of Rennick Bay a new archipelago of small, rocky, ice-covered islands was discovered.

Then, between longitudes 150 and 145 east, comes a gap in the coast. Mapping of it was prevented by bad weather. At approximately longitude 145 an area of loose pack ice was found which easily could be negotiated by an icebreaker.

Here an overland flight passed within a few miles of the south Magnetic Pole. No mountains were observed. The continental ice cap rises gradually to an altitude of 8,500 to 9,500 feet above sea level.

To Determine Wind Direction Aloft, Weather Men Released Balloons

During progress through the ice pack balloons were sent up daily. Their flight could be followed for [illegible]

[illegible] described the [illegible] as [illegible] with [illegible] deep [illegible] in the [illegible]. Along the [illegible] however, [illegible] one of the largest glaciers on earth. From the air it seems [illegible] [illegible] the United States.

Nearly 1,500 Miles of Coastline Mapped

Between the [illegible] [illegible] there [illegible] [illegible] [illegible] for [illegible] [illegible] [illegible] landfall on the continent here might be possible.

There for about [illegible] miles the shore remained [illegible]. But [illegible] possible. There were no [illegible] of [illegible] [illegible] [illegible] the [illegible] from the [illegible] pressed high [illegible] against the coast.

An approximately [illegible] of the [illegible] to a great extent. [illegible] for ship [illegible] and what appeared [illegible] as seen from the air.

[illegible] the party [illegible] Byrd's [illegible] in their discoveries. The [illegible] had been on the most [illegible] of névé. There were few [illegible], no hidden [illegible]. But [illegible] continent in extending the [illegible] of the known world [illegible].

[illegible] nearly 1,500 miles of [illegible] could be placed on [illegible] world's maps.

With Candy He Tries to Beguile a Native Flapper

[illegible]

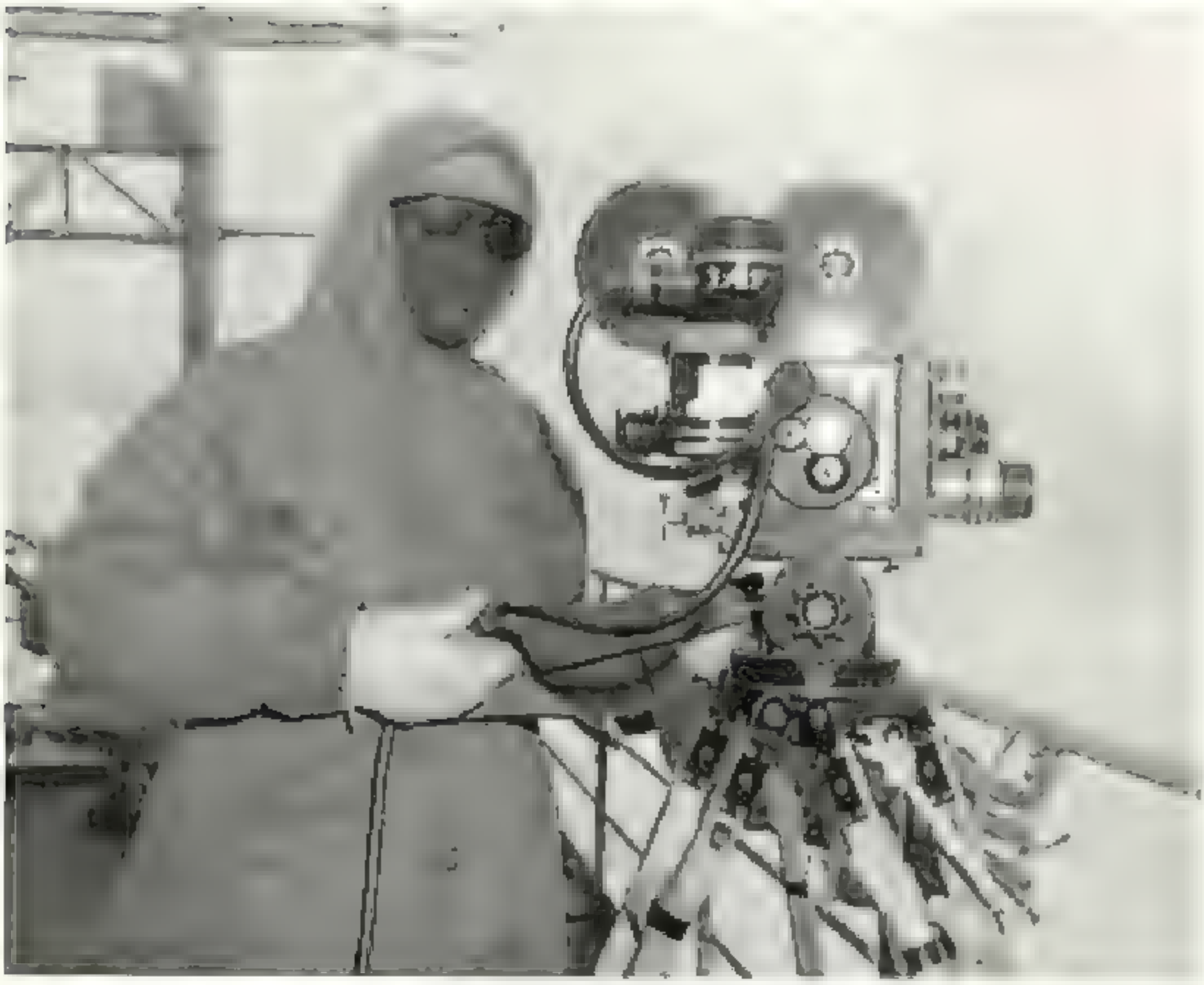
[illegible] South Pole [illegible] the Antarctic coast [illegible] evidence of [illegible].

Vivid Oasis in Land of Death

The [illegible] was destined for [illegible].

The broad picture of the Antarctic Continent is that of a lofty desert of ice out of which rise here and there high peaks of [illegible].

[illegible] square miles of [illegible] possibilities of a snug [illegible] where remnants of the life of [illegible] have survived and continued their evolution in a [illegible] environment.



This Fiendish-looking Fellow Is a Harmless Navy Photographer

T. H. Malone operates a movie camera in full [illegible] clothing, including the effective face mask, which makes him look like something [illegible] The [illegible]

ment? This question excites the imagination but, scientifically speaking, the answer is no. [illegible] areas are known to exist in the [illegible] inhospitable Arctic. On the Antarctic Continent such areas are probably less hospitable, with higher forms of life, especially vertebrates, nonexistent.

It remained for a Western Group LBM to discover and conduct a preliminary exploration of the most remarkable of these [illegible]

[illegible] Commander the crew of the flying [illegible] commanded by Lt. Comdr. David E. [illegible] of Coronado, California, found themselves [illegible] a landscape which made them question their own eyes—a land of blue and green [illegible] brown hills in an otherwise [illegible]

[illegible] "oasis" was by far the most [illegible] so far as public interest was [illegible] geographical [illegible] (See Plate VII, [illegible] 475.)

A few days later the same plane landed on one of the large lakes for a superficial survey of one of the most remarkable regions on earth. An island suitable for life had been found in an ocean of death (page 516).

The plane seemed to have dropped out of the 20th century into a land [illegible] years ago when land was just starting to emerge from one of the great ice ages.

The area of this ice-free region is somewhat more than 300 square miles. It contains three open-water lakes, each large enough to provide a smooth three-mile take-off for a [illegible] of water.

These lakes are [illegible] by jumbled masses of barren, red fish-brown rock. All is walled by ice with a fluting white and amethyst rampart rising [illegible] as 4[illegible]

From lake to lake, [illegible] the water [illegible] from sky-blue to green. Occasional [illegible] streaks were seen. These color variations are due chiefly to the dominant life forms in each

like. The waters contain countless billions of blue-green, green, red, and brown algae, single-celled plants which are among the most primitive living things on earth today.

No Life but Algae and Birds Seen

Both the green and the blue-green algae are the organisms which form the green scum on stagnant water everywhere. The brown and red, commonly known as rockweed, represent a long step upward in evolution.

These algae were the only life found in a hasty survey, but it is not certain that higher forms might not be revealed by a more extensive search. The observers saw no plant life on the rocks. A few birds of undetermined species were noted. Eventually these are likely to bring from the outside world seeds of higher plant life.

The lake region was described as approximately square. The ice banks rise very abruptly about 100 feet on the east and south. North and west there is a more gradual rise. One of the lakes has a gently sloping bench several hundred yards long, described as well suited for a camp site.

The water temperature was "comfortable." All the plane crew dragged their arms in the lake and testified it was much warmer than the approximately 30° temperature of Antarctic ocean water. Analysis shows that it contains about two-thirds as much salt as ordinary sea water. Floating about were a few small ice cakes broken from a large near-by glacier.

The rock hills were of various brown shades. It was first reported that they contained iron ore. But this is only the opinion of the flight crew, without means of verifying their speculations. A reddish color means the presence of iron oxide, but not necessarily concentrated iron ore.

The area starts approximately five miles inland from what is assumed to be the coast. North of this coast is a band of open water about 20 miles wide, beyond which pack ice extends northward nearly 100 miles.

The northern edge of this pack appears to be the closest approach for ships, since the ice is thick and with no discernible open-water leads. The region would seem however, to be easily accessible by air, with any one of the three large lakes affording a safe landing site.

The simplest explanation of the oasis is that this is an area left bare by a retreating glacier which once reached as far as the Shackleton Shelf Ice.

The reddish-brown rocks, once free of ice, would absorb considerable amounts of solar radiation during the perpetual daylight of the Antarctic summer. This heat then would be reradiated, thus constituting for the oasis Nature's own version of the new "radiant heated" home.

The newly discovered lake region apparently differs from any of the other ice-free Antarctic areas in that it is surrounded by ice on all sides.

Whatever the origin of the oasis, it is disappointing that one of the most interesting areas, both scientifically and scenically, in Antarctica must be left for the present hardly more than a dot on the map.

Two weeks later another flying boat of this same group, flying along the almost uncharted coast of Queen Maud Land, came unexpectedly on one of the scenic wonders of the world. This was a range of ice crystal mountains, luminously blue to the observers, more than two miles high and towering for many miles over an ice shelf (map, pages 436-7).

While over these ice mountains, the plane was gale-tossed in the fury of early winter.

Like a Landscape on Another Planet

This had been intended as a last flight from the *Cacomack*. Lts. W. R. Kritzer and F. L. Reinholt started on what was expected to be a routine photographic mission to map about 300 miles of coastline.

They soon found themselves flying over a hitherto unobserved ice shelf, one of the most extensive in Antarctica. The blue walls of this shelf towered above the sea along what previously has been charted as coast. Thus, as a result of this flight, the old coast disappears from the map.

Then the plane turned southward to the equally unanticipated mountains, which reached altitudes estimated at more than 12,000 feet. They were followed for nearly 100 miles and no break was found.

This chain is apparently a major link in a still vaster range which may prove one of the greatest in the world. Beyond these mountains lies the high plateau supposedly reaching to the South Pole.

The mountain range was interpreted as the actual coastline, constituting a seldom paralleled meeting of mountain and sea. There can be only a very narrow land shelf at the most in front of the gigantic, ice-covered precipices.

"It was like a landscape on another planet," said one of the pilots.

The last accomplishment of the group before early winter gales made further operations impossible was investigation of a previously known ice-free area covering more than 100 square miles.

Arctic or Antarctic, It's All the Same to a Husky

Snug in a hole in the snow, his sled dog slept through a mild blizzard. Only one of the dogs had had previous experience with Arctic weather conditions, but their ancestry stood them in good stead and apparently they suffered no discomfort from freezing snow and [illegible] limits. If dogs are brought back alive, the expedition were brought back safely to civilization.

It consisted of a string of green lakes separated by brown and reddish hills of jumbled rocks. One of the lakes was estimated to be more than four miles long. The lakes were mostly blue-green, but a few were red streaked and one was black. Some were dark green in the center but shaded to blue at the edges.

Evidence here suggests that [illegible] cleared of ice by a retreating glacier and with some subterranean heat source. Straight black strips as wide as a two-lane highway were seen on the ice-free rocks. These were interpreted by the plane crew as the remains of old lava flows. They may, however, be strips of glacial deposits.

Near this rock at the foot of the Westfold Hills on the Ingrid Christensen Coast the explorers found a huge bay extending about 50 miles beyond what hitherto has been assumed to be the coastline. It apparently is one of the finest natural harbors in Antarctica.

During the two months of active operations, 55 flights took off from the Western Group. Of these, 23 were solely for the purpose of mapping. Eight were incidental to determine the condition of the pack ice and make weather observations. Captain Bond had accomplished one of the finest pieces of exploration in all history.

The Eastern Group consisted of the seaplane tender *Pan Island* with three planes and flight crews, the destroyer *Henderson*, and the tanker *Cimarron*. It was commanded by Capt. George J. Dufek, of Chevy Chase, Maryland.

This group rendezvoused around Peter I Island at 68.50 south latitude and 90.35 west longitude, under the shadow of 3,937-foot, ice-armored Lars Christensen Peak, a few days before New Year's.

Eastern Group Explores Forbidding Area

Captain Dufek's immediate task was to map the coastline east of the 120th meridian and to explore the continent beyond this coastline. This area extended for hundreds of miles and generally lay between Little America and the tip of South America.

For more than a century up to 1940, explorers had been attempting to get into this area, but had been turned back by impossible weather plus an impassable ice pack that guarded its secrets. No one had any idea where the Pacific Ocean ended and the continental land began.

Up Comes a Whiskered Weddell Seal for Air and a Look Around

In all times, when so fierce blows freeze over, the creatures cut through the ice with tusk teeth (page 612). Southernmost mammals in the world, they live all winter literally covered in the icy, presumably on layers of [illegible]. On the ice they travel with a swimmer's motion at a surprisingly fast pace.

In 1929 and also in 1934 we had tried a [illegible] and again to penetrate this section with flights from Little America, but each time were blocked by storms or bad visibility. Here indeed was a challenge.

Finally, in 1940, I determined to try a new technique, which was to carry a small seaplane aboard my ship, the *Bear*, to proceed along the northern edge of the impenetrable ice pack, and to wait there patiently for the weather to break.

It turned out that the rule of patience, always a good one for conquering the Antarctic, steering clear of its vicious, snapping jaws, was the best one for this job.

Our patience at last was rewarded. We made three important flights by taking quick advantage of one good break in the weather [illegible] and at last the elusive coastline that explorers had sought for so long.

I have brought this incident of a previous expedition into this story to provide a proper setting for an incredible human experience that befell members of this expedition. Commanding officer of the *Bear* at that time was Lt. Comdr. (now Rear Admiral) Richard H. Cruzen, and the navigator of the *Bear* was Lt. (now Capt.) George Dufek. Thus Dufek was a veteran and also he was an old friend.

It was on two of these flights that I discovered the great Kohler Range, the Walgreen Coast and the Fletcher Islands. There were indications of a peninsula, but it remained for Dufek, after a spectacular take-off, to fly over this peninsula and discover the Dennis and Noville Mountains.

Dufek and I had found the ice pack very heavy, solid and tough—impenetrable, in fact; and between it and the Walgreen Coast was a great body of open water, the Amundsen Sea (sometimes referred to as Roosevelt Sea).

Light Phenomenon Causes Tragedy

Somewhere on the land between Dufek's 1940 flight track and my flight track of a few hours later, which was east of his, there was a spot on the fleck and lonely snow where nine young Navy men, seven years later, would come for an instant face to face with eternity by a trick of fate so incredible that it seems it could not have happened.

And yet a sad proof that it *did* happen are three shallow graves in the snow where three young Americans lie.

With my binoculars I must have had a good view of that general area when we passed that fateful spot. Would that I could

Down the Ship's Gangway a Human Chain Passes Box after Box of Gear

[illegible]

[illegible] was [illegible] to see what was [illegible] in the [illegible] of that [illegible]

[illegible] in 1939 [illegible] in [illegible] back there seven years later with this expedition and orders to explore it. We had had only [illegible] the coastline, and we knew that we would have to come back again to get its trend [illegible] and to fill in the cartographic details.

Dufek now, as before, had to wait for the weather. Finally, on December 30, 1946, our [illegible] the trig PBM5 with nine men aboard lifted from the water and headed for the coast. Lt. (jg) Ralph Paul LeBlanc was senior pilot and Lt. (jg) William H. Kearns [illegible] Hence [illegible] well [illegible] Paul, [illegible] pilot [illegible] with LeBlanc [illegible].

I think I was what went through the minds of [illegible] experienced airmen as they [illegible] the [illegible] pack under a 400-[illegible] ceiling. Soon the continent loomed up. The ceiling was now 1,000 feet, but the weather was still not good and they had dim views of ice and snow and the dark [illegible] mountains. But on they went to [illegible] their mission.

After a while they reached an area where the islands covered more of the [illegible] and [illegible] [illegible] great [illegible] where there was no [illegible]. There [illegible] weather it was [illegible] ice or snow. There was [illegible] with which to judge [illegible].

They didn't like it. [illegible] so they decided to return [illegible] the ship and Kearns, who had [illegible] LeBlanc [illegible] the [illegible] something that felt like [illegible] [illegible]

the throttles forward. The instant they reached full power there was a terrific explosion and obliration for all hands.

The plane broke into four pieces, and the wreckage and the unconscious men skidded along the gently sloping snow surface, probably for many feet. It was hours later when survivors came out of their daze sufficiently to understand clearly what was going on.

But three of the crew never regained consciousness. They are lying near the wing tip of the plane with flags of the United States at their heads. They were the first human beings in the history of the world ever to reach that lonely coast and they will be the last ever to leave it. They are men of the Navy, and their [illegible] Frederick Warren Williams, aviation machinist's mate, first class, and Wendell K. Henderson, aviation radioman, first-class.*

Six Survivors Rescued

The heroism of Kearns and James H. Robbins, aviation radioman, second class, who rescued LeBlanc, and LeBlanc's subsequent heroism as he lay grievously wounded, with his feet frozen, are already matters of record.

The courageous struggle of the six men for survival, with their final rescue through the efficiency of Dufek, has been told in detail. Of special note was Captain Caldwell's unselfishness, great stamina, and superb leadership. I shall not, therefore, write of these things here, except to add that Dufek's rescue of his men is in many ways unequaled in all the history of polar rescues.

But I should like to make one remark before passing on to other matters. These young men who crashed were not polar explorers. They had never seen the Antarctic Continent, and one can get little actual conception of it from hearsay.

One is generally introduced to Antarctica by degrees, and even then it is awe-inspiring. But these young men, after their plane exploded, came out of their daze—woke up, as it were—lying on the continent and in one of [illegible] inhospitable spots. It was like dying and going to life in another world.

This was the first time any lives had been lost on any expedition I have led within the Arctic or Antarctic Circles. Naturally, such a disaster disturbed me, although I was still in the United States preparing to head south on the aircraft carrier *Philippine Sea*.

I felt, nevertheless, that responsibility for the tragedy was mine. I had briefed and started the expedition on that strange phenomenon of multiple light reflection visibility, which I discuss later in this article (page 510), but that it did not get down through the chain of command to the pilots of that plane was my fault.

After the rescue, Dufek headed eastward to investigate the area south of the Bellingshausen Sea.

Weather conditions were exceptionally bad throughout January. Day after day missions were canceled. Late in the month Admiral Cruzen at my request ordered the entire group to move westward into the Amundsen Sea.

A considerable part of its coastline was unexplored. There was reason to believe that weather conditions would be more favorable in this area, and this proved to be true almost from the first.

Amundsen Sea lies roughly between meridians 100 and 125 west (map, pages 456-71).

Upon return of our previous expedition in 1941, I had requested that the coastline of the Amundsen Sea be placed on maps as a dotted line. Though we had discovered the continental land, we could not get a good idea of the coastline. That was why I was so anxious to have this area thoroughly explored.

Captain Dufek fulfilled our highest expectations. He confirmed, beyond all question, the existence of the Kohler Range, which turned out to be a larger and more extensive range than I had supposed.

It extends southward towering over the western shore of an extension of the Amundsen Sea. Our peak rises more than 15,000 feet above sea level, an altitude higher than any point in the United States.

Large Bay Discovered

One of the outstanding discoveries of the expedition was a bay that may be 20,000 square miles in area. It reaches more than 200 miles into the interior of the continent. This great indentation is doubtless one of the most important bodies of ice-covered water in Antarctic regions.

It extends about 150 miles from east to west, making its shape roughly that of an oblong. It rises in a high ice wall marking the Amundsen Sea's southern coast and lies within a double arc of high mountain ranges.

There were two other mountain ranges, hitherto unmapped, along the eastern shore. Five peaks were counted with altitudes of at least 6,000 feet and 35 which rose 2,500 to 3,000 feet. (All these altitudes, it must be understood, are taken from sea level, not from the high surface of the ice cap.)

* The surviving members of the crew not mentioned in the text are William Arthur Hines, Walter Auburn, machinist's mate, second-class, and Owen McCarty, chief photographer's mate.

Men Handy with a Hammer Put "Snowshoes" on a Tractor

[illegible]

[illegible] Great glaciers [illegible] into [illegible] Frost Flowers [illegible] 5 to 50 [illegible] brought [illegible] types.

[illegible] the [illegible] continent are [illegible] all [illegible]

[illegible] walls 100 feet high. On the [illegible] are piled in [illegible]

[illegible] Gaston Land, [illegible] 75 W. [illegible] Palmer [illegible] Weddell Sea [illegible]

[illegible]

Antarctic Stowaways Ride to Work on a Tractor-drawn Train

Construction battalion men are hauled back up to the Ross Shelf Ice to work on the camp site at Little America IV after a midnight cruiser alongside ship moored to the ice in the Bay of Whales. This was the customary method of transportation over the bay ice. Some times as many as ten sledges would be attached to one tractor.

this largely uncharted coast and into the unknown interior, and especially to solve, from the Weddell Sea side, the problem of the possible passage between the Weddell and Ross Seas (page 487). But the season already was too far advanced. Sea swells, high winds, fog, snowstorms, and formation of new ice in sheltered water prevented the launching of another successful flight.

Area Half Size of USA Covered

I know that if any man living could have made flights in this area, Dutch could have done it. He had performed superbly, fighting what was probably the worst flying weather any human has ever been up against.

During the flights of our three groups an area more than half as large as the United States was covered. Of this, at least 340,000 square miles never had been seen by man before (map, page 467).

It also was possible to explore about 75,000 square miles of ice-strewn ocean where no ship had ever sailed.*

More than 5,400 miles of coastline were discovered, relocated, or corrected. Counting bays and indentations, the total would be considerably greater.

Ten new mountain ranges, among them some of the loftiest on earth, were discovered. New archipelagoes, peninsulas, islands, and seas were placed on the map. Some of the

* These figures are tentative, as given by the geographer on the basis of pilots' reports. Completion of the calculations made from photographs, a time-consuming task, will make necessary some revision.

Thousands of Air Photographs Permit Study of Areas Never Before Seen by Man

Aboard *Mount Olympus*, Lt. Comdr. J. C. McCoy (right) and Lt. John H. Rosse. [illegible] with the aid of stereoscopes. These were taken on a [illegible] Antarctic Research Expedition.

world's largest glaciers were found to flow [illegible] from a great [illegible] on the enormous Antarctic plateau, [illegible] to nearly 11,000 feet above sea level and, for the first time, [illegible] of the vast plateau [illegible] which [illegible] were [illegible] for the first time explored.

Here were [illegible] discoveries such as that of the large [illegible] region of [illegible] lying near the edge of the continent. Here VIII [illegible] was [illegible].

[illegible] the whole [illegible] and more accurate portrait of the [illegible] which [illegible] like a [illegible] lies below the [illegible] ice with a highly [illegible] surface [illegible] images.

The [illegible] photos, literally hundreds of [illegible] from [illegible], [illegible] the [illegible] that [illegible] has been a matter of geographic [illegible].

The expedition accomplished more in the way of [illegible] general geographic knowledge of the [illegible] than any other expedition. The [illegible] applied, of course, to [illegible] scientific research [illegible] the [illegible] expedition [illegible].

more was accomplished in geographical discovery than by all other Antarctic expeditions combined.

Antarctica a Vast Laboratory

A major consideration in all Antarctic exploration is research in pure science. It comes second only to the [illegible] and exploration discoveries, which [illegible] other scientific discoveries.

Here has been set up the Norwegian [illegible] where [illegible] are [illegible].

Here the [illegible] of the [illegible] stored through thousands of generations the very small [illegible] of life that [illegible] has become adjusted to the most [illegible] possible conditions.

Here the [illegible] are [illegible] the [illegible] of terrestrial magnetism [illegible] of particles from the [illegible] the phenomena of the aurora [illegible].

The expedition [illegible]

scientists recruited both from the experimental laboratories of the military services and from such Government scientific bureaus as the Geological Survey, the Fish and Wildlife Service, and the Coast and Geodetic Survey.

Their activities unfortunately were limited by the brief periods during which it was possible for them to operate and by transportation difficulties. Nevertheless, their accomplishments were considerable.

For instance, our scientists made difficult and highly intricate studies of such subjects as the rapid pulsations in the earth's magnetic field, which impaired radio communication between Little America and what at that time was the Weather Bureau's farthest-north station at Thule, Greenland.

They measured variations in the speed of sound through various forms of ice and névé. They studied the spectrum of the eerie purple light which came through thick roofs of ice over their dugouts.

They made collections of those extraordinary microscopic living things, the pelagic plants and animals—plankton—which live and multiply in contact with ice itself and which, abounding in countless trillions in the cold seas, apparently constitute the base of the entire pyramid of Antarctic sea life.

Telescope of Time

Upon Antarctica lies, very approximately, some four million tons of ice.

This ice may be likened to rock. It has the characteristic crystalline structure of all rock.

The behavior of such a great shell of ice, covering nearly 4,000,000 square miles and presiding a mile thick in places, epitomizes in some ways the behavior of the rock shell of the entire planet over millions of years.

The Andes and Himalayas are only [illegible] episodes of the earth's long history, but they are episodes of far greater duration than all the time of the existence of the human race. But here in one man's lifetime—on a miniature scale but resulting from almost exactly the same sequence of events—several "mountain ranges" 100 to 150 feet high may be erected out of the rock called "ice."

Antarctica thus becomes for the geologist a telescope through which he can look backward over the vast gulfs of time between the ages to study certain aspects of the folding of rock as the astronomer looks across the emptiness of space between the stars.

As many observations as were possible in the limited period allowed were made by Dr. Arthur H. Howard, of the U. S. Geological Survey. His chief service was in outlining the field for future research. Probably hundreds of future Ph. D. dissertations in geology will be based on observations of Antarctic phenomena.

Ice Mountains a Perilous Fairyland

For the mountain-building studies it was necessary to go only about three miles from the Bay of Whales to be in a fairyland reproduction of the Jura Mountains of Switzerland, which Dr. Howard had visited some years ago. Rolling ridges of luminous blue ice up to 150 feet in height form a narrow belt running southward about 20 miles to ice-covered Roosevelt Island.

The spectacle probably will last about five years more before the pressure of ice from inland pushes it into the sea.

The region where these studies were conducted is one of the most perilous in Antarctica. It can be entered with reasonable safety only by men roped together and walking single file. It is full of deep, hidden crevasses covered by light snow bridges which make necessary step-by-step progress and constant probing ahead with poles.

In a pit dug and blasted into the Ross Shelf Ice by geologists of our last expedition, working in a constant temperature of several degrees below zero, Dr. Howard made direct observations of the evolution of ice under pressure. This pit was sunk first 23 feet below the snow surface at Little America about six years ago and left for future observers.

Since then some 18 feet of snow had accumulated over the surface, approximately three feet a year.

The result, as determined by Dr. Howard, is that the depth of the original pit has been reduced between five and six feet by the tremendous pressure of this accumulating weight. This apparently is the genesis of the steel-like glacier ice formed by compressing névé, the sandlike snow peculiar to an ice age.

Before they left, geologists of our last expedition bored auger holes in the wall of the pit. These were nearly perfect circles. Howard found them flattened into ellipses, but those near the top of the pit showed the greatest flattening.

Thus is epitomized the process which results in the birth of an ice age over thousands of years. Snow of one winter presses down on the snow of the preceding winter and compresses it into ice—a different type of ice from that which results from the quick freezing of the surface of a lake or the water in a rain barrel. This ice in turn compresses the ice underneath.

Before completing this study, Howard drove vertical rows of spikes into the walls of the

Admiral Byrd, Dr. Siple, and Lt. Richard E. Byrd, Jr., Visit Little America II

[illegible]

[illegible] Scientists Study Frozen Insects

[illegible]

Cooling under Antarctica's Ice Skin

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

to detect submerged submarines. It measures from the air minute variations in the intensity of the earth's magnetic field, such as would be caused by so large a mass of metal as a submarine.

As soon as the existence of the instrument became known to the U. S. Geological Survey, it was obvious that it might prove of enormous value for wide-scale geological explorations.

It had previously been determined that this magnetic intensity showed considerable variation with the major types of rock—igneous, sedimentary, and metamorphic—because of their different magnetic properties, and with the contours in which they were arranged.

It has been observed that "the magnetometer starts where radar ends." It might be described as an X-ray radar, by which one can see under Mother Earth's skin.

Land under the Icecap Probed

Surveys of more than 200,000 square miles in the United States and Alaska showed that the magnetometer fulfilled all its promise. It was of special value in locating geological structures which most frequently are associated with petroleum deposits.

For purposes of exploration, the instrument was improved so that an automatic, continuous record of magnetic intensity was correlated constantly with a plane's position in space, to obtain an uninterrupted recording of the geomagnetical structure of the country flown over.

Such an airborne magnetometer was operated on four flights from the Little America base by James R. Bassler, Jr., of the Geological Survey staff. The overall result was to demonstrate that it was possible to record in this way what lay under the Antarctic icecap.

Near the eastern edge of the Ross Shelf Ice is Roosevelt Island. It is believed to constitute the fulcrum upon which two ice shelves, the Ross and Prestrud, turn to form the Bay of Whales a few miles to the north. But it is completely ice-covered to a depth of about 500 feet. It partly protrudes from the rest of the shelf. Even its existence has been debatable. Bassler's magnetometer record has shown unmistakably that it is a real body of land, composed chiefly of granite rock.

A somewhat smaller island, shown on maps at the entrance to the Prestrud Shelf, slightly to the southeast, was demonstrated either not to exist or to be composed of sedimentary rocks. The former conclusion is considered more probable.

Another flight was over the Edward VII Peninsula and the Rockefeller Mountains. In this area laborious geological studies have been made on the ground. It had been determined that the mountains are composed largely of granitelike rocks. The magnetometer, from a thousand feet above, gave precisely the same results.

On the other hand, the instrument showed that that magnificent landmark, La Gorce Peak, named for my old friend Dr. John Oliver La Gorce, was composed almost entirely of sedimentary rocks compressed from accumulations made through millions of years.

At one point the edge of the Ross Sea was found 20 miles east of the line designated on existing charts. A source of peculiar satisfaction was the finding of considerable magnetic intensity variation in the neighborhood of Kainan Bay. Dr. Siple had predicted, from the nature of crevasses there, that the point must represent a break of some sort in the earth's structure—probably an island. The magnetic readings verified this supposition.

The detector element of the magnetometer is housed in a streamlined, bomb-shaped case known as the "bird," which is towed behind and beneath the plane on a cable 100 feet long. This is to eliminate the magnetic effect of the metal in the aircraft itself. The measurements are so delicate that every possible contaminating factor must be removed to make valid conclusions.

Undoubtedly there are both valuable and precious minerals under Antarctica's ice. It is difficult to conceive of such a large part of the earth's surface without them.

The magnetometer can at least give a good indication of where to look. It cannot identify specific minerals, such as gold or uranium. It can detect, as has been demonstrated in the case of oil, the geophysical formations where they are most likely to be found.

South Magnetic Pole a Large Oval

Study of the earth's magnetism itself naturally has a notable part in the program of an polar expedition. This field of science was represented by Dr. H. Herbert Howe and Lt. A. Schoene, both of the Coast and Geodetic Survey.

Available evidence indicates that the South Magnetic "Pole" must be considered a roughly oval region, perhaps more than 1,000 square miles in area. At numerous points in this oval a compass needle on a horizontal axis would point straight downward, and these points would change position from day to day. The actual "pole" might be considered as the mathematical center of this region.

The North Magnetic Pole has shifted somewhat in the past few years. The South Magnetic Pole evidently has shifted also, but we haven't enough data to prove it.

That strange phenomenon which Dr. Siple calls the "antithesis of darkness," and which caused our aerial tragedy (page 502), constitutes one of the constant perils of the Antarctic, and must be understood before it can be conquered. It is especially important for airplane landings, which require fine judgments of the elevation and contour of the snow surface. It is a weird white light experienced chiefly on cloudy days when a wool-like fleece covers most of the sky.

On such days there are no shadows. Nearby objects, especially men dressed in white, vanish and reappear without warning.

Sunburns, although no sun is visible, are likely to be severe, and the worst-burned areas may be the bottom of the chin and the palms of ungloved hands. Visibility is extremely bad. Elevations and depressions which ordinarily serve as landmarks are merged into an endless white flatness. Walking becomes a blind staggering because there is no way of judging the level of the snow surface.

Weird White Light a Danger Source

On such a day tractor and sledge parties away from base in unknown territory can proceed very slowly, if at all. The absence of shadows leaves the men with no means of detecting the parallel windrows of arched snow which indicate crevasses.

In the North a similar phenomenon, known as "Arctic white-out," has caused airplane accidents.

Dr. Siple's tentative hypothesis is that this "antithesis of darkness" can be explained as a phenomenon of multiple reflection of sunlight. Visible and short-wave invisible radiation is trapped between earth and sky.

Ordinary sunshine striking the earth is partly absorbed by the varicolored landscape and partly reflected back into space. Here there is only the unbroken whiteness of the sky. It is an almost perfect reflector.

The radiation rejected by the earth cannot get past this cloud screen into free space again. A certain amount of it is reflected back against the snow, to be re-reflected against the clouds.

Thus there is a constant building up of trapped light, which is added to that received each instant from the sun itself. Light is coming from above, from below, and from all sides where there are snow-covered slopes. The area within the Antarctic Circle is like a titanic hall of mirrors.

This trapped-light hypothesis obviously is only a tentative attempt to explain an eerie phenomenon of the polar regions. The explanation remains debatable.

Antarctica is swaddled in a warm blanket. This remarkable fact was established by daily soundings of the upper atmosphere by radiosondes, the astounding little robot observers which can be sent aloft by free balloon and which send back a continuous record of the conditions they encounter.

Here Stratosphere Is Closer to Earth

Over the Equator the temperature drops with altitude up to about 60,000 feet—the floor of the stratosphere there.* Thenceforth it remains constant or may even show slight increases.

Over Antarctica there is a different situation. Two thousand feet above the earth throughout the summer was found a layer of atmosphere about 500 feet thick in which the temperature generally was eight to ten degrees higher than at the ground. One recording was 14 degrees higher. Such inversions of temperature are known elsewhere.

Once this stratum is passed, the temperature declines steadily to about 60 below at 23,000 feet. In the next mile of altitude it increases about five degrees.

This means that Antarctica's summer stratosphere [illegible] that over the Equator and two thirds as high as that over the United States. In winter it is about the same as in summer, or possibly a little lower.

Flasks were filled with South Pole wind air which had moved northward at least a thousand miles over the continent at an altitude of more than 6,000 feet—for chemical analysis at the Bureau of Standards.

Breathing Antarctic atmosphere has a curiously exhilarating effect. It is one of the attractions which bring men back to these frozen wastes on expedition after expedition.

No Colds till New Men Arrived

While the winelike quality of winds over the ice mountains doubtless is partly psychological, there remains the fact that this air is a slightly different mixture of gases from that of air in middle latitudes. It contains, for example, less than a third as much water vapor as atmospheric samples collected at the Equator. Further studies with respect to the amounts of carbon dioxide, nitrogen, oxygen, and argon are still being made.

Antarctica is sterilized by millions of years

* See, in the National Geographic Magazine: "Exploring the Earth's Stratosphere," by Lt. John A. Macready, December, 1926; "Ballooning to the Stratosphere," by Auguste Piccard, March [illegible] "Man's Fight [illegible] World," January, 1936; and "Scientific Results of the World-Record Stratosphere Flight," May, 1935.

An Injured Arm Gets Expert Attention at the World's Southernmost Hospital

[illegible] Little America IV. [illegible] R. H. Rob[illegible] [illegible]

[illegible] Navy [illegible] Now [illegible]

Among the [illegible] [illegible] until the arrival of new men late in January and planes from the aircraft carrier [illegible]

They brought with them a [illegible] cold virus, which were transmitted [illegible] the warm sun warders us, and soon there was a mild epidemic [illegible]

In the [illegible] [illegible] over the [illegible] region most of the time. The method fun[illegible] runs up to about 50,000 feet (page 496).

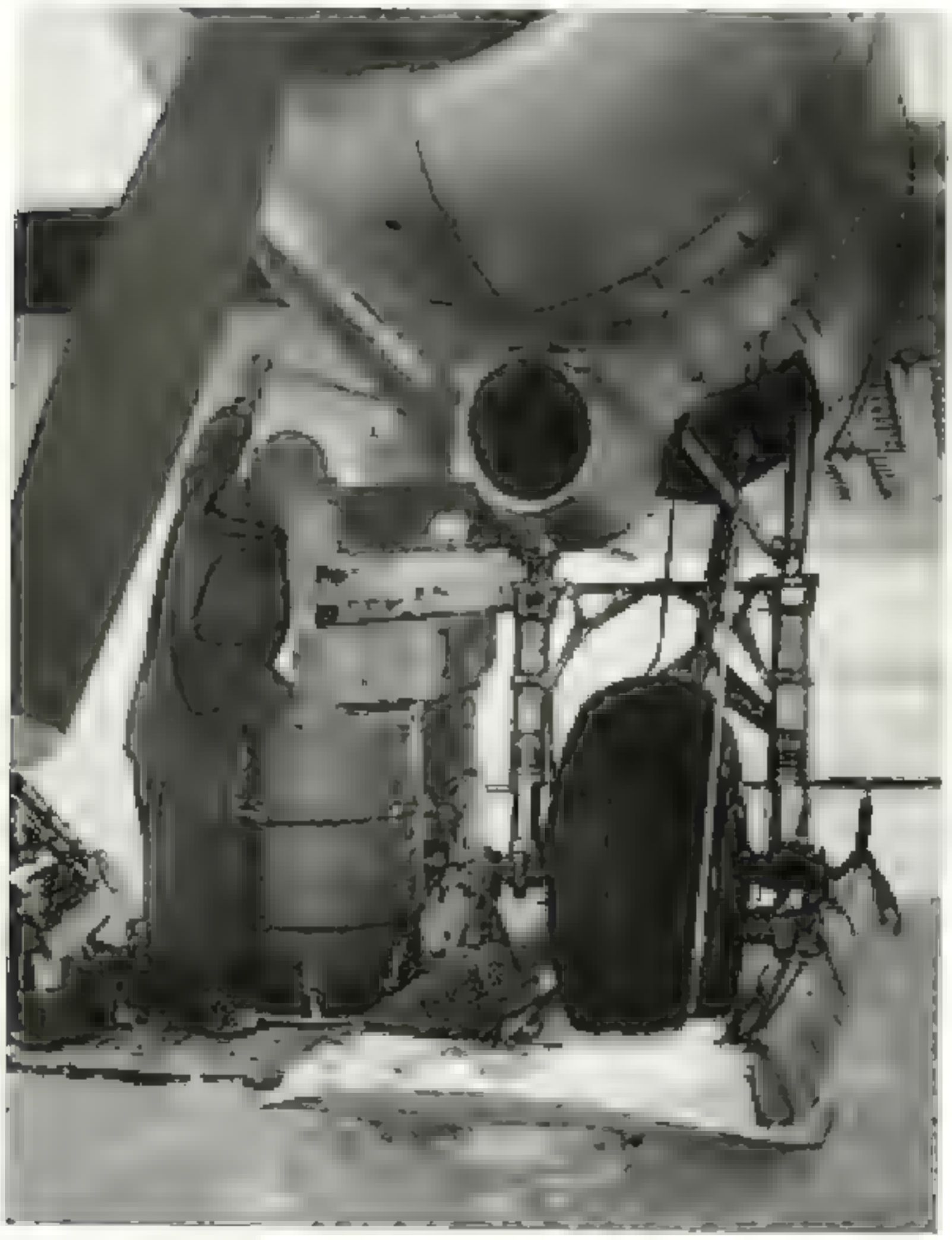
Some curious meteorological phenomena were observed. One day at Little America for example, there was a cloudless sky with perfect visibility for about eight hours. It was possible to follow with the [illegible] [illegible] weather balloon up to 25,000 feet before it finally faded from sight in a deep-purple sky across which shone the planet Venus. There was a green-red horizon.

Sun Ringed with Rainbow Halo

The green color of the horizon was [illegible] and apparently has not [illegible] [illegible] The most beautiful [illegible] was a halo of the sun [illegible] [illegible] rapid [illegible] [illegible] in part to the almost complete absence of [illegible] in the Antarctic [illegible]

There were rapid [illegible] [illegible] [illegible] [illegible]

[illegible]



Ski-wheel Landing Gear Enabled the R4Ds to Take Off from a Carrier and Land on Snow

[illegible] of the flight from the *Philippine* [illegible] A second crew member is passing up the plane [illegible]

[illegible] through [illegible] the [illegible] and [illegible] to the earth.

These [illegible] for Antarctica [illegible] which indirectly [illegible] affect [illegible] world south of the [illegible] [illegible] the Polar Plateau sweeps outward from western Victoria Land near the South Magnetic Pole. It crashes into warm [illegible] near the Balleny Islands and [illegible] are born.

These grow rapidly, sweeping eastward across the Ross Sea, and finally decay in the Rockefeller and Queen Maud mountains.

The other cradle is probably near Mount Ruth Siple on the western edge of the Amundsen Sea. Here apparently the cold polar air sweeps through some wide gap in the mountains and encounters southward-blowing winds. Thus [illegible] cyclones are [illegible] which move eastward, gathering strength, and finally decay somewhere over the Palmer Peninsula.

[illegible] for the origin of major storms in two of the four quadrants into which, for convenience, Antarctica or Lindenia is divided.

Several minor areas of storm center activity also were found by the Eastern and Western Groups operating in the other quadrants. [illegible] with the great [illegible] Antarctic weather [illegible] for future expeditions.

"Blue City" of Southernmost Mammals

A few miles from the base, hidden among [illegible] of Wedell seals, gave [illegible] a [illegible] of Weddell seals, gave 5,011. These crews were the world's southernmost [illegible] and the interspecific [illegible] of pressure ridges in the Ross Shelf [illegible] blue light and [illegible] deep, hidden crevasses marks the southern limit on earth of warm-blooded mammals.

[illegible] a permanent summer and [illegible] Hundreds were counted by the surveys conducted from the base. They [illegible] the ice within [illegible] Ross Sea waters for [illegible] their staple food. When these bays freeze over several inches thick in early autumn, the

creatures cut windows through the ice with their teeth.

Dr. Alton A. Lindsey, assistant biologist of my second expedition to the Antarctic, watched these seals at work. "Swinging the entire head from side to side," he reported, "with the mouth held open at an angle of 150°, they cut a double groove by use of the canines (and perhaps incisors also) of both jaws."

In winter these strange animals disappear, but they do not desert their "blue city." They apparently huddle on ledges on the sides of the crevasses all the winter night, with temperatures as low as 70 below outside. They supposedly have access to the sea at most times. On the snow they can outrace a man, but ordinarily show no fear.

The animals seem complete masters of their harsh environment. When fish are plentiful they store enormous amounts of blubber to sustain them in hard times. Females, for example, eat nothing for a week after pups are born, but, drawing on this blubber for food, are able to give enough milk for a single pup to gain as much as seven pounds a day.

There was some speculation as to whether the ice drift had not carried their home canyon among the crystal mountains too far away to allow them further access to the sea. In that case, they would be doomed to slow death from starvation.

This can be determined only by a later expedition. It seems improbable, however, that such naturally intelligent animals, with instincts built on countless generations of experience with ice, would have allowed themselves to be trapped in such a fashion. The "blue city," it is most likely, remains their home and not their prison.

Two Geographic Ghosts Are Laid

On the edge of the Antarctic sonic depth findings confirmed the nonexistence of two century-old phantom lands, in the positions previously reported for them.

First were the "Nimrod Islands," at latitude 56.30 south and longitude 158.40 west. They first were reported by Capt. Henry Eilbeck in the *Nimrod* in 1828 after his ship had been blown off course during a passage around Cape Horn. He described high mountain peaks, hosts of birds, and fields of marine vegetation in the water.

On our expedition the ships *Pawney* and *Merrick* made radar soundings over a 20-mile radius around the reported position. They found only ocean about two miles deep.

The second ghost laid was "Swain's Island," in latitude 56.30 south and longitude 100 west.

It apparently was the ice-born hallucination of the Nantucket whaler Jonathan Swain who in 1809 recorded the position of a large island surrounded for miles by fields of red water due to the presence of minute crustaceans known as "krill," which concentrate in colonies of countless trillions. They usually indicate that land is somewhere in the vicinity.

Here also the expedition's depth findings showed only water two miles deep.

Both Filbeck and Swain may have seen exceptionally large icebergs drifting slowly northward, eventually to disintegrate in the warmer waters of the Pacific.

Sometimes these are enormous. In January, 1927, for example, the Norwegian whaler *Odd I* passed a tabular iceberg the area of which was estimated at 10,000 square miles, or approximately the size of Maryland.

Another explanation is that both ship captains were victims of mirages. They presumably were too far north to have observed much Fata Morgana "blink," the magnified reflection of ice formations against the sky, in whose fantastic configurations anybody [illegible] to see anything, from the skyline of New York City to an island in the mid-Pacific [illegible] with fronded palms.

Certainly there was no suggestion of charlatanism about the "discoveries." They were reported merely as matters of routine before the day when scientific methods of observation were well established.

16-ton Tractors Make Six-day Journey

A six-day land journey into the Rockefeller Mountains and return, a total of 280 miles, with two 16-ton amphibian tractors was one of the most important experiments, as regards future exploration in polar regions, conducted by the expedition.

The party was led by Capt. Vernon D. Boyd of the U. S. Marine Corps, a veteran of Antarctic exploration (pages 481, 489).

The immediate objective was to establish a gasoline cache and weather station for the planes, but of significance also was the test of the possibility of using specially equipped heavy tractor vehicles for long overland journeys, such as a comfortable march from the Bay of Whales to the South Pole.

Such a journey would be beset by many unpredictable complications. Transportation has been the nemesis of south polar expeditions in the past, with dog teams generally recognized as the most reliable means for long incursions into the interior. But this is the gasoline age. Sooner or later some explorer will motor overland to the Pole.

Our previous expeditions have experimented

Tons of Ice Break from the Ross Ice Barrier Almost at the Photographers' Feet

Crews in the Ford and emphasize the danger of coming so close to the barrier's face, here about 80 feet above the water and broken ice of the Bay of Whales. O. F. Rowe, Chief Photographer's Mate, is [illegible] to beat a quick retreat as he pores over the Ford. The dark area at upper left indicates a "water" reflected from the Ross Sea.

with motorized transport across the endless wastes of thinly crusted and sandlike névé with indifferent success, but each failure where we recognize our mistakes can be regarded as a step forward.

Our heavy tractors exerted a pressure of about 12½ pounds per square inch, or more than three times the maximum permissible. The two carried seven men and their gear—a load of nearly 3,000 pounds—on the Rockefeller Mountains trek.

Gasoline, food, and equipment sufficient for three months in case the party became marooned were carried on heavy sleds. Two were dragged behind each tractor.

The vehicles averaged seven miles an hour, moving steadily a quarter of a mile apart. The party traveled almost directly eastward over the ice of the Ross Shelf.

It was a region beset with death traps for heavy vehicles. These were wide crevassed areas where the great chasms in the ice were concealed by thin snow bridges.

Problems of visibility and navigation were important from the first. The sky was overcast nearly all the time. This resulted in a condition of shadowless low visibility in which it was impossible to detect the parallel ridges in the snow which indicate crevasses.

Nevertheless, only once did a tractor break through a snow bridge and then, fortunately, after it had straddled the chasm.

Mirages Paint Horizons with Illusions

Throughout the six days the sun was visible for only three hours; so Captain Boyd had to navigate entirely with the magnetic compass, which is highly unreliable in the Antarctic. The experience must be given due consideration in plans for any future tractor incursion deep into the continent. Boyd recommends some sort of gyrocompass.

Such Warm and Buoyant Suits Save Lives in Freezing Seas

Life-saving immersion suits are tested in water at a temperature [illegible] Fahrenheit. [illegible] Wearing [illegible] pounds over ordinary clothes, they were [illegible] warm. The war to [illegible] [illegible] in the sea [illegible]

Perhaps the most interesting feature of the trip was the continuous panorama of mountains. All one day great walls of cream-colored and dark-blue icebergs loomed ahead of the tractors. Sometimes they would merge into a solid blue wall. It seemed as if the party rapidly was approaching an iceberg-filled sea.

Actually this was a projection against the sky of Okuma Bay, which cuts into the Ross Shelf Ice about 60 miles to the north.

At the end of the route a party climbed Mount Helen Washington for geological specimens and a visit to the seismograph station set up by the last expedition. There they found two marble tablets used by Roy Ed Fitzsimmons as a base for his instruments. Boyd brought them back with him as a possible base for a memorial to Fitzsimmons, who was killed in the war.

As a result of the trip, Captain Boyd was convinced that even the 16-ton tractors with certain improvements could be used for a much longer trek, even to the Pole itself. It would be necessary to provide heat for the space occupied by personnel and some sort of living quarters.

With the vehicles in their present condition, Captain Boyd points out, the trip would have been impossible earlier in the season. The tractors' ground pressure was too great. By mid-February, however, the surface of the snow had hardened. Even so, the machines sank from eight to ten inches [illegible] and probably would have bogged down over any great distance.

Scott's Camp Perfectly Preserved

Antarctica is an useless land where nothing, except the physiological system, grows old. This hardly could be better illustrated than by the camp of Scott's 1901-04 expedition on Ross Island, at McMurdo Sound, where Admiral Cruzen landed late in February from the tender *Barton Island* to survey the

For the First Time in History, Men Land on a Lake in Antarctica

Narrowing the blue-green water is one of the wing floats of the Martin Marauder [illegible] moored to the moist of the remarkable "oasis." Beyond rise icebergs on [illegible] aerial survey failed to [illegible]

possibilities of establishing an auxiliary [illegible]

Scott's camp could have been [illegible] only a few weeks ago. The prefabricated cabin [illegible] England still stood in perfect condition. The birders [illegible] to come for photos [illegible] were [illegible] have come from the press.

A birthday [illegible] rations was so completely undeteriorated after 43 years that it was used without hesitation to secure the helicopter in which Admiral [illegible] had flown from ship to shore. A few [illegible] scattered about looked [illegible] biscuits [illegible] were [illegible] rather tasteless.

And there was the "[illegible]." A Russian [illegible] to the [illegible] of a [illegible] in the ice. Paper [illegible] if the publication had come from the press [illegible] a few days before. But this journal had been printed in [illegible].

Scott's 1911 [illegible] on the [illegible] set out on his ill-fated journey to the South Pole, was also visited by task force personnel. It appeared somewhat disordered after the buffetings of 35 winters. Snow had drifted through cracks in the planks of the sealed [illegible] nearly ice-free volcanic ash.

The [illegible] which they had [illegible] about. Scattered around the cabin were [illegible] of matches ignited easily.

Just west of this camp the great [illegible] Glacier, one of the most impressive sights in the Antarctic, rises 7,500 feet through the mountains. Two graves on a hilltop are covered with beautifully [illegible] snow came from the [illegible] of three-tiered Mount Erebus on Ross Island (page [illegible]).

Killer Whales, Seals, and Penguins

An unusual abundance of the dreaded orcas, or Killer whales, was found in McMurdo Sound waters, and brown cliffs of the shore were covered with [illegible].

The season was so near its end that [illegible] remains one of the best [illegible] for expedition leaders.

This expedition was so large that I have had difficulty in condensing its story into a magazine article—even one as long as this. Thus there were many outstanding men and officers to whom it has been impossible to give the credit they so richly deserve. This has disturbed me, even though I realize that it would require several volumes to describe adequately a 4,000-mile expedition. However, since I have covered the expedition by groups, I should be remiss not to mention two: the veterans of our former expeditions and the representatives of the press and radio.

11 Correspondents, 12 Antarctic Veterans

There were nine members of the press and two radio commentators. The three great press associations, several large newspapers, and the major broadcasting systems were represented.

I was not used to so many reporters. On each of my other expeditions I had had only one, and he carried on also as a member of the expedition. So I wondered how it was going to work out with 11 of them.

I soon found out. By the time we got settled at Little America I had seen enough of the men of the press to know that I could look upon them as true and loyal members of the expedition. They were thoughtful and considerate, and as square a group of men as I had ever in all my long career come in contact with in any walk of life.

At Little America I lost all desire to censor anything the correspondents wrote. Their judgment and craftsmanship were such that I didn't even check their stories for accuracy.

These 11 correspondents renewed my faith in our free press, and I am human enough to be very grateful to them.

Our personnel included 12 veterans of former expeditions. Since this was a naval expedition, it was not practicable to take more.

They supplied to the expedition such technical knowledge of Antarctica as the Navy lacked. Officially, their contribution was inestimable, and, personally, it was a joy to have them with us. They were all at Little America but Admiral Cruzen, who was taking the ships north, and Jack Perkins, biologist, who had broken his leg.

We used to meet at least once a day in what we called the veterans' tent. Of course we knew a lot about each other, and the razzing that went on there I am certain was a world's record.

They were all tried and true men or you may be sure they would not have been along. Many of them have been mentioned elsewhere in this article.

They were, in addition to Cruzen, Siple, and Perkins: Waite, Boyd, Dustin, McCoy, Lt. C. C. Shirley, USN., Richardson, A. J. L. Moreney, chief warrant officer, US Army, Capt. M. W. Weiner, US Army, and R. R. Johnson, chief boatswain's mate.

We evacuated Little America on February 23, 1947, and the ships of all three groups left Antarctic waters early in March. The polar winter had started, making highly perilous and impractical any further air exploration.

The expedition had been on the whole highly successful.

The returns from an expedition sufficient to have financed the war for only a few moments had brought a notable advance in man's knowledge of the planet on which he lives, a contribution for all time to come.

Still, much of the continent remains unknown. There are many secrets behind the glittering ice ramparts and the painted white curtains of fog and gale-tossed snow. The final conquest of Antarctica remains perhaps for another generation of explorers.

What value has Antarctica to repay such effort and expense as was involved in this expedition? This so frequently is asked that it deserves a frank answer.

At the outset, it may be stated that, in terms of any financial return now or in the immediate future, it has no value whatsoever. Perhaps this will be a sufficient and conclusive reply to many of the questioners.

One day, it is quite possible, somebody will make money out of the bottom of the world. We know, for example, that there are huge reserves of coal there. The black mountains are full of it. It is impossible at the present stage of exploration even to make a wild guess as to the extent of these deposits.

But any mining operations, especially when we consider the difficulties of transport, would be fantastically impractical at this time. There may come a day, however, when the world will need this coal.

Almost certainly oil will be found under the ice. It is impossible to imagine a large continent without vast mineral wealth of many kinds buried in its rocks.

The Antarctic a Proving Ground

For the Navy's own purposes, much was learned about celestial navigation and ship operations in polar regions.

On this expedition the Navy equipment and personnel were subjected to the worst possible conditions. We operated deliberately late in the Antarctic season. It was an excellent opportunity to meet and learn how to overcome many situations which certainly will be en-

Watch an Icy Boom in Her Teeth, the *Westwind* Smashes Out a Basin in the Bay of Wrales

[illegible]

From the Bay of Whales to Washington, D. C.: Blackjackets and Marines Form an Honor Guard to Greet the Flagship *Mount Olympus* as a Yard Craft Nudges Her to the Pier at the Naval Gun Factory

When Being Introduced, Mr. Penguin Looks the Other Way

Navy James Forrestal a more [illegible]

[illegible] the shortest route between the Eastern and Western Hemispheres, is [illegible] around in any future major conflict.

The United States owns no land [illegible] far north to undergo as [illegible] the most severe Arctic conditions. Even the northernmost point in

[illegible] must be trained to cope with the [illegible]

[illegible] will find more to battle there in the Far North.

Foods Could Be Stored Indefinitely

[illegible]

[illegible] can be stored indefinitely—perhaps [illegible] a [illegible] lifetime—and needed. There [illegible]

[illegible]

[illegible] will Nature. [illegible] The [illegible] a New [illegible]

There are no [illegible] things on earth such as these [illegible] green and purple sky with pink [illegible] and yellow and [illegible] and [illegible] and [illegible] the [illegible]

There [illegible] years [illegible] colors. [illegible] for eyes to [illegible] this [illegible]

Here Nature [illegible] aside for man a [illegible] of beauty and in [illegible] such [illegible] elsewhere [illegible]

I have known few who have gone south of the Antarctic Circle who have not [illegible] out of [illegible] for a [illegible] another realm of thought. Here is a [illegible] through which [illegible] little was [illegible] short time [illegible] from [illegible] civilization into the space and [illegible] the cosmos, and for a moment be a part of it.

"Don't Take It So Hard, Old Man"

Jack Perkins, expedition biologist, stuffed frozen fish down the gullets of [illegible] calms an emperor penguin's frayed nerves before starting the feeding [illegible]

[illegible] of the [illegible] where [illegible] the Southern Cross [illegible] the sky. This greatest value is an intangible [illegible] spiritual [illegible]

Antarctica's Sermon in Ice

[illegible] the purity, the elevation above the petty quarrels and ambitions of men and nations, combine to [illegible] of what man should want most, peace on earth.

Antarctica is a sermon in ice. But there is also [illegible] there at the bottom of the world [illegible] and sublime. Its beauty is harmonious.

A summer visitor could not know much about this [illegible] the long winter night — [illegible] the coasts of the Antarctic during the summer.

[illegible] Antarctica [illegible] for the [illegible] to [illegible] and peace are all yours just for the taking of them. There is no easy way. They have to be won. They have to be fought for. You have to go up against the elements of Antarctica to realize them fully.

And [illegible] Nature [illegible] enables you to see and value the good, but

Safety Lamp, Adventure Bond and Bravery Medal Receive the Navy's "Well Done"

[illegible]

[illegible]

Antarctica's Eternal Challenge

[illegible]

[illegible]

The Society's New Map of the Caribbean Area

GREATLY increased knowledge acquired by American airmen on wartime flights over the Caribbean area has enabled the National Geographic Society to map this important region in far more detail than ever before. The result is the 10-color map, "Countries of the Caribbean," which accompanies this issue of the NATIONAL GEOGRAPHIC MAGAZINE.

Just 455 years ago this month, Christopher Columbus made his first discoveries here, groping among the islands off the slender waistline of the Western Hemisphere and thinking he was off the coast of Asia.

Since that time, many explorers, geographers, navigators, buccaneers, treasure hunters, and fishermen—even hurricanes and volcanic eruptions—have altered the geographic picture. But it remained for the modern aerial camera to give new distinctness and accuracy to coastlines, river courses, and mountains almost everywhere south of the Rio Grande.

The Cartographic Section of the National Geographic Society worked six months to epitomize the four-and-a-half-century accumulation of facts on this 41-by-25-inch map for The Society's 1,600,000 members.

Insets Show U. S. Possessions, Bases

Extending from Mexico's Tijuana to the mouths of the Orinoco in Venezuela, the new map area includes a slice of the southern United States as well as all of Mexico, Central America, and the West Indies—a winter vacation land of tropical greenery, deep blue water, and glistening coral sand.

Of its 6,954 place names, few would be recognizable to Columbus. One would be San Salvador (Watling Island), in the Bahamas, where the discoverer and his men first landed in the New World, bearing the Admiral's Green Cross banner and the royal standard of Spain. Kneeling upon the shore, they gave thanks to God "and kissed the ground with tears of joy, for the great mercy received."

Where Columbus found only a few Indians and cruised along virgin verdant coasts, today are populous republics with millions of people and not a single possession of Spain.

As a master mariner headed for the Orient, he would doubtless be most interested in the Panama Canal, "dividing the land and uniting the world." The Canal Zone inset on this map shows the projected third lock system intended to accommodate larger ships and make the vital artery less vulnerable to attack.

This large-scale inset is one of eleven which highlight areas of special interest. In one corner appear the Caribbean possessions of the United States—Puerto Rico, the Virgin Islands (two insets), and the Canal Zone. In another are insets of islands on which the United States has military bases—Cuba and the six islands on which the British granted us bases in 1940 in exchange for badly needed destroyers: Trinidad, Jamaica, Exuma, St. Lucia, Antigua, and Bermuda.

In the patrol which met the challenge of Axis submarine warfare, every square mile of the "American Mediterranean" was combed by air and sea again and again.

Most of the land area is now covered by United States Army Air Forces trimetrogon photographic surveys made in cooperation with the local governments. Results of these and of many new ground and sea surveys are incorporated in The Society's map.

Pilots will note much new information concerning altitudes of mountains. For example, two elevations of 8,202 and 10,301 feet are shown in the Dominican Republic, where earlier Caribbean maps show 5,545 feet as the highest definite peak.

In western Venezuela are peaks of 15,321 and 16,427 feet. Older maps show 15,564 feet as the maximum height of the Cordillera de Mérida.

A unique mountain is Mexico's amazing Paricutin, the young volcano which has sprung from a cornfield on a 7,500-foot plateau in the State of Michoacán to a height of 9,000 feet above sea level and is still growing.†

The map incorporates new census material from Mexico, Cuba, Jamaica, and the Bahama Islands. All four have increased sharply in population: Mexico 1930—16,552,722; 1940—19,473,741; increase, 17.7 percent. Cuba 1931—3,962,344; 1943—4,778,583; increase, 20.6 percent. Jamaica, 1921—858,118; 1943—1,237,063; increase, 44.2 percent. Bahamas, 1931—59,806; 1943—68,846; increase, 15.1 percent.

A new boundary, agreed upon after nearly 50 years of arbitration, divides Costa Rica from Panama. The treaty was concluded on May 1, 1941, and President Roosevelt sent both governments a message lauding the settle-

* Members may obtain additional copies of the new map, "Countries of the Caribbean, Including Mexico, Central America, and the West Indies" (and of all standard maps published by The Society), by writing to the National Geographic Society, Washington 6, D. C. Prices, in United States and Possessions, 50¢ each, on paper; $1 on linen; Index, 25¢. Outside United States and Possessions, 75¢ on paper; $1.25 on linen; Index 50¢. All remittances payable in U. S. funds. Postage prepaid.

† See "Paricutin, the Cornfield that Grew a Volcano," by James A. Green, NATIONAL GEOGRAPHIC MAGAZINE, February, 1944.

ment. The new boundary was actually demarcated on September 15, 1944.

For the first time accurate boundaries of the Senatorial Districts in Puerto Rico are marked. This boundary delineation is based on the work of a Puerto Rico planning commission using a map completed by the U. S. Geological Survey in 1943.

Projection Tuned to Air Age

For this map your Editor and The Society's cartographers chose the Transverse Mercator projection.

The ordinary Mercator projection may be considered as developed mathematically upon a cylinder tangent to the spherical earth around the Equator. For some 15 degrees on each side of the Equator, such a cylinder closely approximates the actual surface of the sphere, so that the scale change or stretch is at a minimum.

In using this projection in transverse, or oblique, form, as is done on the new National Geographic map, we may consider the cylinder as tilted on the sphere so that its line of tangency is no longer the Equator but some other great circle of the cartographer's choice.*

On this map the great circle which forms the axis of the projection has its vertex at 20 north latitude and 87 west longitude. From there it runs in a straight line across the map, passing just north of Mexico City and San Juan, Puerto Rico.

Like the Equator in the conventional Mercator projection, this is the line of zero deviation in scale. Since all parts of the map lie within 15 degrees of this line, the scale variation is slight, reaching a maximum of 3½ percent along the top and bottom borders of the map. Through the whole central area the scale change is negligible.

The NATIONAL GEOGRAPHIC MAGAZINE in 1921 pioneered in the use of the Transverse Mercator for mapping a long airplane flight, and today the projection is widely used for great-circle flight strip maps. It is admirably suited for general maps of certain areas and was used for The Society's Southeast Asia map (October, 1944).

Important to the navigator at sea or in the air is the fact that, in addition to reducing the scale variation to a minimum, this projection maintains strict conformality; that is, in any small area of the map the scale is the same in all directions and every place is in its true direction from every other place.

Roads, railways, and commercial airports are shown throughout the area. The entire Inter-American Highway, as the Mexican-Central American section of the Pan American Highway is called, is indicated by an emphasized red line, with uncompleted sections dashed.

There are now only two impassable stretches between Laredo, Texas, and the Canal Zone. One of these begins at Trinitaria, in southeastern Mexico, where a 150-mile section running into Guatemala is now under construction. The other impassable stretch of 120 miles lies in Costa Rica and Panama.

From the Canal Zone eastward there is no road beyond Chepo. The section through the Darien Peninsula has not been traversed or surveyed. From the Canal Zone the motorist must ferry across to Barranquilla or Buenaventura, Colombia, or La Guaira, Venezuela.

All of the Central American countries are carrying on highway construction projects, but rugged mountains and steaming jungle make roads hard to build and defend against encroaching Nature.

Ninety International Airports Now

Air transport in this region has increased remarkably. In 1939 there were about 50 airports in the Caribbean area with scheduled international service. Now this number has grown to 90.

Also a number of local air services have been established in the area. Planes now haul horses, cattle, hogs, chickens, and many other creatures, from fish to chinchillas. Industrial equipment is flown to hitherto inaccessible areas and products are shipped out by plane. Frog legs from Cuba and many perishable tropical delicacies now are flown to United States markets.

One cargo of specially processed coke was flown from New Jersey to Cuba so big sugar mills could keep going in a fuel emergency.

The war caused a tremendous boom in Latin-American production of minerals and such products as rubber, abaca (Manila hemp), quinine, cotenone, tung oil, palm oil, cork, and kapok, primarily obtained from distant parts of the earth.

If the war tore much of the rest of the world to pieces, it emphasized the interdependence of the American republics; and that dependence upon one another comes to a focus in this area, which encompasses the Caribbean highway between the Americas and the approaches to the Panama Canal.

* For an illustrated description of this projection see *The Round Earth on Flat Paper*, by William [illegible] cartographer. Copies of this work, an introduction to map projections, are obtainable from the Secretary, National Geographic Society, Washington 6, D. C., at 50¢ each in the United States and Possessions, elsewhere 60¢. Postage is prepaid.

Guatemala Revisited

By Lois Marden

ELEVEN years ago I went to Guatemala [illegible] GEOGRAPHIC MAGAZINE. At that time, [illegible] awesome; we used big glass plates and a tripod camera. Exposures were slow; subjects had to "hold it" for one-tenth to one-half second. Nothing that moved very fast could be photographed.

Recently I went back. This time I could make color pictures in split fractions of a second, catching the fleeting smile or frown, and record the bustling life of crowded market places. Plates in the following pages show some of the photographs I made.

Guatemala begins at the Mexican border with a vast jungle area, where chicle tappers slash forest giants, but most of the Republic's people live in the *Altos*, or Highlands, in the hollow of sleeping volcanoes.

Highlands Little Changed; Capital Modern

The Highlands of Guatemala have changed little in four hundred years, but I found that the capital, Guatemala City, had expanded since my 1910 visit. Virtually surrounded by deep ravines, the city has stretched suburban tentacles out between the fissures. Old trough [illegible] and splendid new buildings, [illegible] ent National Palace (pages 540, 559), rise from colonial foundations.

Sixth Avenue is the Fifth Avenue of Guatemala City. Here a race that was old when Cortes came to the New World presses its brown nose flat against plate-glass windows displaying products of the machine age. Brightly dressed Indians carrying loads of wood or vegetables trot unnoticed among smartly dressed Guatemaltecos.

Though pure-blooded Indians form more than half the population of the Republic, Guatemala City is the most metropolitan capital between Mexico and the South American mainland. High in a valley nearly 5,000 feet above sea level, the spotless city has a spring-like climate the year round.

Aromatic highland coffee forms the country's chief export, while among Indian small farmers corn remains a staple subsistence crop. Certain scholars think that the New World's pre-Columbian agriculture, which was based on corn, may have been born in Guatemala, for here grows *teosinte*, a wild grass allied to maize.

Realizing the importance of agriculture and animal husbandry to Guatemala, the United States sent as its Ambassador to the Republic Lewis J. Kyle, former Dean of the School of Agriculture of the Agricultural and Mechanical College of Texas.

Mr. Kyle has arranged visits between agricultural experts of both countries. Students come from Guatemala to the United States on scholarships to study farming and cattle breeding.

"You're My Half a Life"

In writing of Latin America, I have tried to record some of the graphic phrases and turns of speech in each country. I found Guatemala no less imaginative in the use of metaphor than its neighbors.

For example, if your Guatemalan girl friend says you are "half a life," she is complimenting you, not ridiculing your lack of vitality.

A Guatemalan monologue might go like this:

"Miguel over there is a long one, but as he has a lot of neck, he never puts himself in a shirt eleven yards long. At lunch today he was with 50,000 devils because the chicken we ate defended itself so well. But that wool is for the tiger now, though his cronies still think he is half a life.

This means: "Miguel over there is a sharp customer, but as he has a lot of pull, he manages to keep out of tight spots. At lunch today he was furious, because the chicken we ate was so tough. But that rascal is all washed up now, though his cronies still think he is wonderful."

José Milla, an author of the last century who lived in La Antigua, created the character of Juan Chapin, Guatemala's common man, and through him explains many of the colloquialisms of the language. Milla also wrote historical novels of colonial times, and Guatemalans revere him as the official recorder of national tradition and history.

When Guatemala was the seat of government of all of Spain's Central American provinces, the old capital, now called La Antigua, became a rich, cultured center of the church, arts, and letters. Twice destroyed by earthquake and flood, the "Very Noble and Very Loyal City of St. James of the Gentlemen of Guatemala" was demolished for a third time by earthquake in 1773. Three years later the capital moved to its present site.

Higher and colder than the new city, La Antigua has a savor that is hard to put on paper (pages 531, 549, 550).

People still live serenely in the old town that half sleeps in the bright sunshine of the

To Make Holes Straight Women Wear Jersey and Wear Rubbers Around Their Heads

When Boys Meet Girls in Santiago Within Less Than [illegible]

[illegible]

[illegible]

Girls Receive on a Serious Way

[illegible]

[illegible]

Less Clearness

[illegible]

Yellow Sulphur Streaks the Sides of Restless Izalco [illegible] Volcano

[illegible]

[illegible]

"Business as Usual" During Ruby's Lunchtime in Sololá Market

[illegible]

[illegible] with [illegible] pure tiles and water jars and pitchers I am Yours Pretty One" "Do not Tempt [illegible] for Yours" "I Dreamed that You Loved Me," and an anticlimax in tile, "To Love You Is a Pleasure."

From the patio of a house that an old [illegible] rebuilt in its colonial [illegible]

Indians Weave Fine Textiles

Guatemalan naturals [illegible] the Indians call themselves, [illegible] of textiles. The Palmar colony [illegible] costumes and [illegible] nearly all of [illegible]

[illegible] of [illegible] in New [illegible], [illegible]

[illegible] sheep, and new [illegible] and some garments [illegible] 555, 563

[illegible] women [illegible] times than the men. The women wear [illegible] *huipil* (a loose blouse), a wrap-around [illegible] dress. Colors run through the spectrum from deepest reds through saffron yellow to blue and violet [illegible]

From Antigua you may begin your climb into the Highlands on [illegible] have an all-weather [illegible] go over them even in the [illegible]

[illegible] clothe the [illegible] and wet gray mist swirls up from the [illegible] The cold inland forest gives off a [illegible] and of charcoal fires

Shade Trees of Guatemala City's Parque Central Were Cut to Provide Vistas to the New Palace and Discovered Cathedral

Architects Know the Palace of the Captains General at Antigua as One of America's Finest Examples of Spanish Colonial Architecture

The Staff of Office Marks the Town Santos Palacagua

Cuba village [illegible] [illegible]

[illegible] legged wooden net-covered frame that hang from a tumpline around their heads. With a [illegible] flipped staff to help them set down the load and to rise again, and a rolled-up palm-leaf [illegible], rush sleeping mat, tin lamp and battered coffeepot hanging to the outside, the merchants doggedly tireless along, stopping wherever night overtakes them (p. 54?)

[illegible] hundred pounds, and they [illegible] mile to market [illegible] the [illegible]

is first and foremost a trader. He will walk for days with his produce or his wife's handicraft on his back to some famed market such as those of San Francisco [illegible] Atitlán or San [illegible] Chichicastenango (pages 535, 503).

Though shy, Indians one meets on the roads usually are friendly. They answer questions in the peculiar singsong cadence and intonation of the Indian version of Spanish. Talking rapidly, in a high pitch, they do things to gender, verb forms and pronunciation that would [illegible] out on the knees of a grammarian.

Natives have a great sense of personal dignity. I met one bowed under a tremendous [illegible] of fuel—[illegible] pots, who, pointing to the third [illegible] said [illegible] Señor, you see these cuatro? Well, in the pictures, God and all the saints wear the same things. That proves Indians are the children of God.

But most important to the Guatemalan Indian is religion. His whole life revolves around the religious calendar, with its feast [illegible] carried on with a friend [illegible] to effect: "God, you make everything come out all right—or else!"

Deep-blue Lake Atitlán

Beyond Antigua, 5,000 feet up in the [illegible] mountains, lies deep-blue Lake Atitlán. As you round the shoulder of a mountain at a lookout point called Godfrey, suddenly the lake appears, almost unbelievable in the intensity of its "Kodachrome blue" (pages 536–537).

I stood one morning beside the stone [illegible]

In West Gaston's Stand Members of Dallas Sports Men Wear Gentlemen's Striped Trousers

San Antonio Women Weave and Wear an Intricate *Huipil*

[illegible] Antonio Aguas Calientes, near La Antigua, is one of the few villages that are [illegible] Blouses vary in detail but over-all geometric effect is similar. *Huipiles* are simply made [illegible] like the one this woman weaves, sewn together. The unsewn middle of the warp becomes the [illegible]

has look many [illegible] Gutierrez. The three [illegible] invisible [illegible] the [illegible] feet [illegible]

[illegible] Near the village of San Pedro [illegible] I watched fishermen set long [illegible] baited with bits of stale fish for crabs [illegible] transparent water [illegible] shore. In [illegible] blue water [illegible] spots that shade from [illegible] undulant underwater plants through [illegible] to deepest blue (page 559).

[illegible] fishermen tie the crabs' pincers with [illegible] rushes, then string the crabs on a long stalk. In this way the crustaceans live for three [illegible]

[illegible]

Indians [illegible] to each other [illegible] machel, the [illegible] the man [illegible] of hollowed logs, which [illegible] hewn planks for [illegible] San Juan squat in the [illegible] Catarina and San Antonio [illegible] indifference [illegible]

[illegible] there are [illegible] an Apostle. Actual

View of Seesham and Both Were Bigamists Dies in the Sea by [illegible]

Three Distant Mountains Overlook Deepdene Waters at Lake Marion

Mountain Beech Village Ring on Volcano-formed Lake

[illegible]

Cofrades of San Antonio Palopó Pose with Their Patron Saint's [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Plankton Freshwater Crustacean Transparent Lake Water Make Delicious Soup

Photograph by Luis Sánchez

Two Villages near the Capital Wear Almost Identical Costumes

[illegible]

[illegible] instrument [illegible]

[illegible] Tecum Umán, was [illegible]

[illegible] ceremonial drink [illegible] and [illegible] from a special [illegible]

Marimbas for Sales

Then there [illegible] and [illegible] for sale.

[illegible] Don Mario [illegible] composer [illegible] music, [illegible]

[illegible] *Maderas de Mi Tierra* (Woods of My [illegible] made of [illegible]

Father and Son Furnish Music for Ceremonial Dances in Sidon

[illegible]

[illegible]

Ribbon Weavers and Costume Makers

West of Chi[illegible] town of [illegible] Sun Pr[illegible]

[illegible]

[illegible] ancient ruins (the capital of the [illegible] and in [illegible] volumes three [illegible]

[illegible] of the annual fair [illegible]

Babies Dress Like Mother — Shy Village Girls Cover their Faces from the Camera's Staring Eye

Long Face Wrapped and Skirts Crease Strongly Modern Women in Walk with Short Stubby Steps

Artists Parade Around Elias Headdresses as Part of Tilda Swinton's Noah's Ark

"Up To Still Up?" Women Crane Their Necks to Watch Men Ride Wild Bulls

Hidden Hide of This Vegetation Say Concealed Rifle Holders in the Jungle Days

[illegible]

[illegible] of the United States.

On my return to the capital I [illegible] Mr. [illegible] who wrote a [illegible] in the course of the President's [illegible] speech.

[illegible] will [illegible] the [illegible] of Peten, Guatemala, [illegible] geological [illegible] was premature.

Many Germans owned coffee [illegible] [illegible] coffee, beef, and [illegible]

The Land of Mayas and Chicle

In this hot hinterland the ancient Mayas of the Old Empire [illegible] their vast [illegible] in central [illegible] the Mayas [illegible] [illegible] through [illegible] [illegible]

[illegible]

Chicle for Chewing Gum Flows in the Peten Jungle

A Giant Stick Wears a Bird-nest Beard

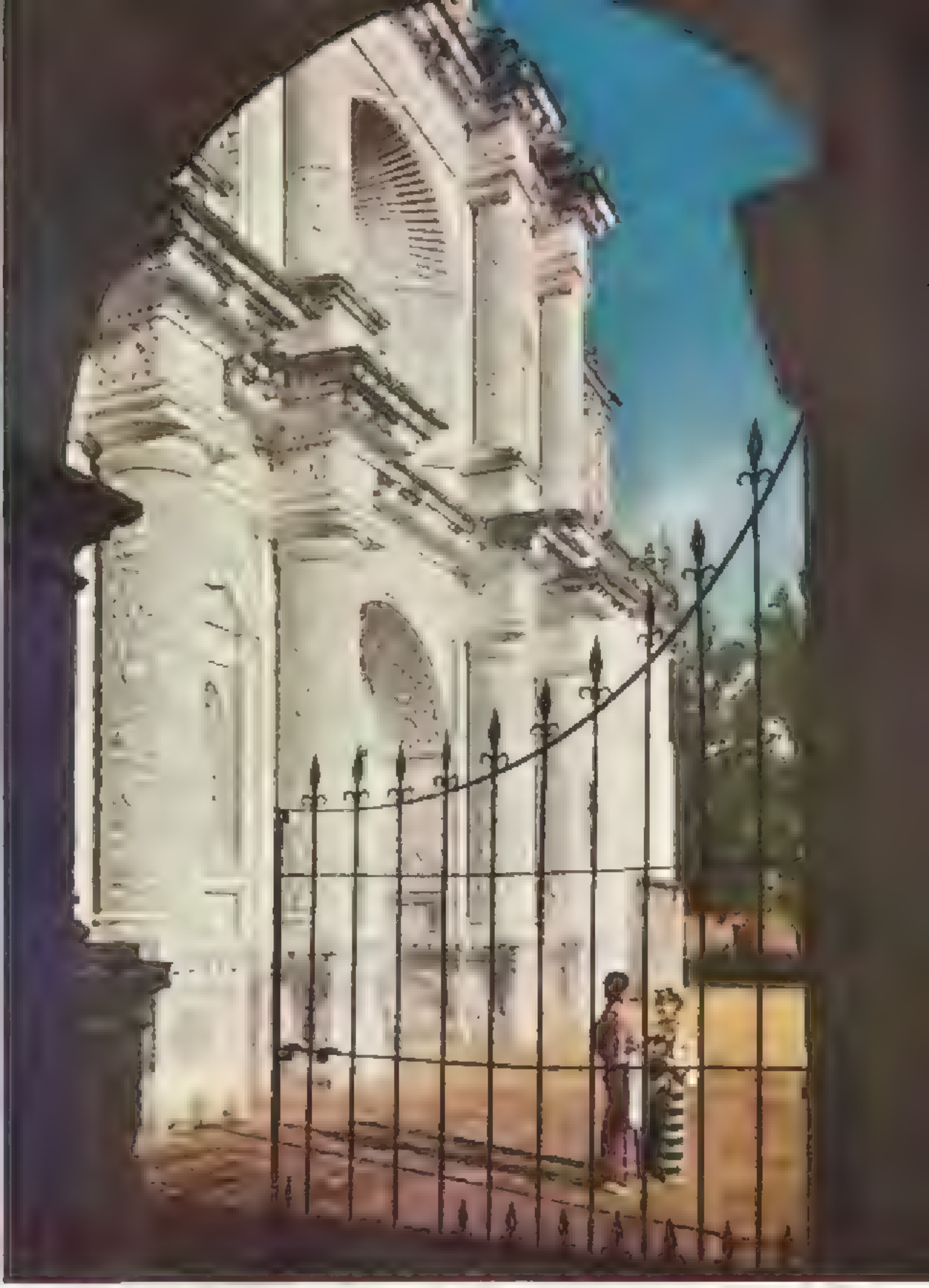
As we flew north, the blue water [illegible]

[illegible]

The Birth of Chewing Gum

[illegible]

[illegible]



Wolfgang Ebendorfer, Franz Gabler, Ilse Nowotnel, detail of the first preservation of Antonius's Chronicles

Rampur Stone Lions Guard the Intricately Carved Entrance to an Dilapidated Aryan House

In Monastery at Shu Pi ya with Incense

Workaday Garb Meet Festive Dress in San Juan Sacatepéquez

Nicaragua, with his stiffened trousers and coat thick with the droppings of countless chicle bleedings.

First, he lifted a splinter of bark near the base of the tree; under this he inserted a canvas bag. From the bag he hacked with his machete a series of cuts up to the first branches high overhead (page 547).

"Unlike rubber trees which may be tapped regularly," said Buster, "sapodilla should be tapped only every four or five years. That's why cutters move to another field from a base camp to look for more trees, since sapodillas never grow in a solid stand. A cutter can tap six to eight trees a day.

"But," Buster smiled, "he won't run out of numbers, as there are about 30 million trees in Peten. Approximately three-quarters of these have already been tapped at one time or another."

Dense red sapote wood was used by the old Mayas in building. In Yucatan I have seen sapote lintels a thousand years old still usually supporting their burdens of stone. But today the Guatemalan Government fines anyone who cuts down a sapote tree $50. They are worth much more standing.

Chicleros boil chicle in big three-legged iron pots. The kind you see in cartoons boil miscellaneous in. Then pour the hot liquid into molds. Hardened blocks go by air to Guatemala City or to Puerto Barrios. Guatemala's export of chicle has been worth from two to three million dollars annually in recent years.

If you fly from Peten down to Puerto Barrios, on the Caribbean, you may pass over another low and lake: Izabal, close to the port of Livingston.

Travelers making the circuit from Coban to the coast go by auto road through places with names like bird sounds in the night: Tamahú and Tucurú, then by road and rail to Panzós, on the Polochic River. From here a launch will take you to Lake Izabal.

A Hunt for Manatees

I was curious to see if manatees (*Trichechus manatus*) still existed in the lake. An American colonel in Guatemala City had told me how, years before, he had seen sea cows sitting in the shallows of the lake and munching weeds, like hillbillies growing turnips.

Manatees are big herbivorous mammals with a snout flattened at the end and a round spatulate tail.

Supposedly the sea cow gave rise to the mermaid legend in the days of sailing ships. One may wonder how anything so ugly (page 540) could pass for a woman. After a sailing voyage lasting many months, an old-time sailor might not have been too critical, particularly of animals whose females sit upright and nurse their calves by holding them against their breast with one flipper, in a curiously human fashion.

At El Estor on the northern shore of the lake I asked for a manatee hunter. A little man stepped forward. "My name is Tranquilino Garcia," he said. The name seems to go with hunters of water animals; in El Salvador another Tranquilino had shown me how to capture four-eyed fish.*

"I am the last of the manatee hunters," said Tranquilino. "In my youth I used to go out with my grandfather, father, and brothers but now I am alone."

Tranquilino puffed on a bulldog pipe. Waving an arm, he said: "The beasts live across the lake. They feed on grass on the lake bottom, but have to come up regularly for air. I'll go ahead in one canoe; you follow with the cameras in another."

Across the lake we disembarked at a village that looked like something in the South Seas. Adobe straw huts on the beach sat women from 12 to 60 crushing nuts of the coyol palm (Acrocomia), from the kernel of which oil would be extracted.

The women wore only a blue wrap-around skirt and a necklace of red beads. With brown breasts rising and falling to the rhythm of the pounding, they nodded their heads and told us, "Plenty manatee in the bay."

Taking his seat in a dugout canoe barely big enough for one man, Tranquilino wrapped his arm about a paddle, clamped his pipe between his teeth and glided out over the smooth water. We followed in a larger dugout.

Harpooning a Sea Cow

Paddling silently over the 15-foot-deep glassy water, Tranquilino suddenly held up his hand. Ten yards ahead the satiny skin of the surface broke to the roll of a glistening gray-brown back; then a flat, round tail tipped up and disappeared. Across the water came a sighing "ah-chuff" of exhaled breath.

Silently (the slightest sound frightens a sea cow) Tranquilino changed direction. He seemed to know where the animal would surface next. When it breached again, this time close to the boat, Tranquilino was ready. Without relinquishing his grip on the pipe, he lifted and hurled the harpoon with one movement. It struck home, and the sea cow sounded with a resounding whack of its broad tail.

* See "Coffee Is Done in El Salvador," by Luis Marden, NATIONAL GEOGRAPHIC MAGAZINE, November, 1944.

Pickaninnies Pip and Sizzle in St. James Rides a Tightrope on 'All Saints' Day

[illegible] Queen [illegible], a Relative Lower Her [illegible] Her Assistants Before All Saints' Day Ceremonies (Chichicastenango)

A Chichicastenango Weaver Counts Colored Threads to Work Design and Owner's Initials [illegible] Shaw

This Little Pig Went to Market and Came Home Again with a New Owner. Along the Highroad [illegible] Chief was [illegible]

Antonio Pasquale Dances Religious Dates. Elaborate Men and Women Walk in "Indian Life" — San Juan Sun Newspaper

Long-tailed, Red-breasted Quetzals Symbolize Liberty and the Republic

[illegible]

[illegible]

[illegible]

Rafts of Red Mahogany

[illegible]

Sailing down the length of Lake Izabal, we [illegible] the Rio Dulce, whose banks, thickly covered with [illegible] growth, [illegible] in places. We passed rafts of red mahogany logs [illegible] to Livingston on the Caribbean.

At Livingston we saw [illegible]

[illegible]

We saw many Caribs in Livingston. Though [illegible] Negroes, [illegible] They speak [illegible] English [illegible] West Indian Negroes [illegible] the coast.

[illegible] I went [illegible] Momostenango, high in the Altos. [illegible]

[illegible]

Slanting Rays of the Setting Sun Gild Gothamite City's Cathedral in Central Park

[illegible]

Intra-Faith Dialogue: Ceremonial Meal, Western and Religious Group Rites in Grace Mediation

Drums, Maracas Make Devil's Dance at Quetzaltenango Fair

Red and La Ling Lanzas Are Bull Dancers' Standard Props

Market Vendors Tuck Their Feet Under for a Comfortable Seat

[illegible]

[illegible] Momo- [illegible]

When I asked [illegible]

[illegible]

[illegible] yellow [illegible] blue or black. [illegible] indigo plant.

"How do you get the other colors?" I asked.

"Well, [illegible]

On Saturday night [illegible] wash them in the [illegible]

[illegible]

[illegible]

When I [illegible]

The Lord of the Burning Place

High on a hill above the town [illegible]

Though [illegible]

[illegible] burning places.

The San Francisco Fire: After Market, Maria Brought Her Mementoes to Blankets, p. 535

Black Hats and Somber Clothes Denote Chief Men in Corpus Christi Day

[illegible]

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In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than [illegible] expeditions, some of which required [illegible] field work to achieve their objectives.

The Society's notable expeditions have pushed back [illegible] of the southwestern United States [illegible] the Atlantic. By dating the ruins of the vast communal dwellings in that region, The Society's re[illegible]

In Mexico, The Society and the Smithsonian Institution, January 16, 1939, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 291 B. C. (Spinden correlation). It antedates by 200 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, Explorer II, ascended to the world altitude record of 72,395 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

The National Geographic Society–U. S. Navy Expedition camped on desert Canton Island in mid-Pacific and successfully photographed and observed the solar eclipse of 1937. The Society has taken part in many projects to increase knowledge of the sun.

The Society cooperated with Dr. William Beebe in [illegible] record depth of 3,028 feet was attained.

The Society granted $25,000, and in addition $75,000 was given by individual members, to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California were thereby saved for the American people.

One of the world's largest icefields and glacial systems outside the polar regions was discovered in Alaska and Yukon by Bradford Washburn while exploring for The Society and the Harvard Institute of Exploration, 1935.

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[illegible]

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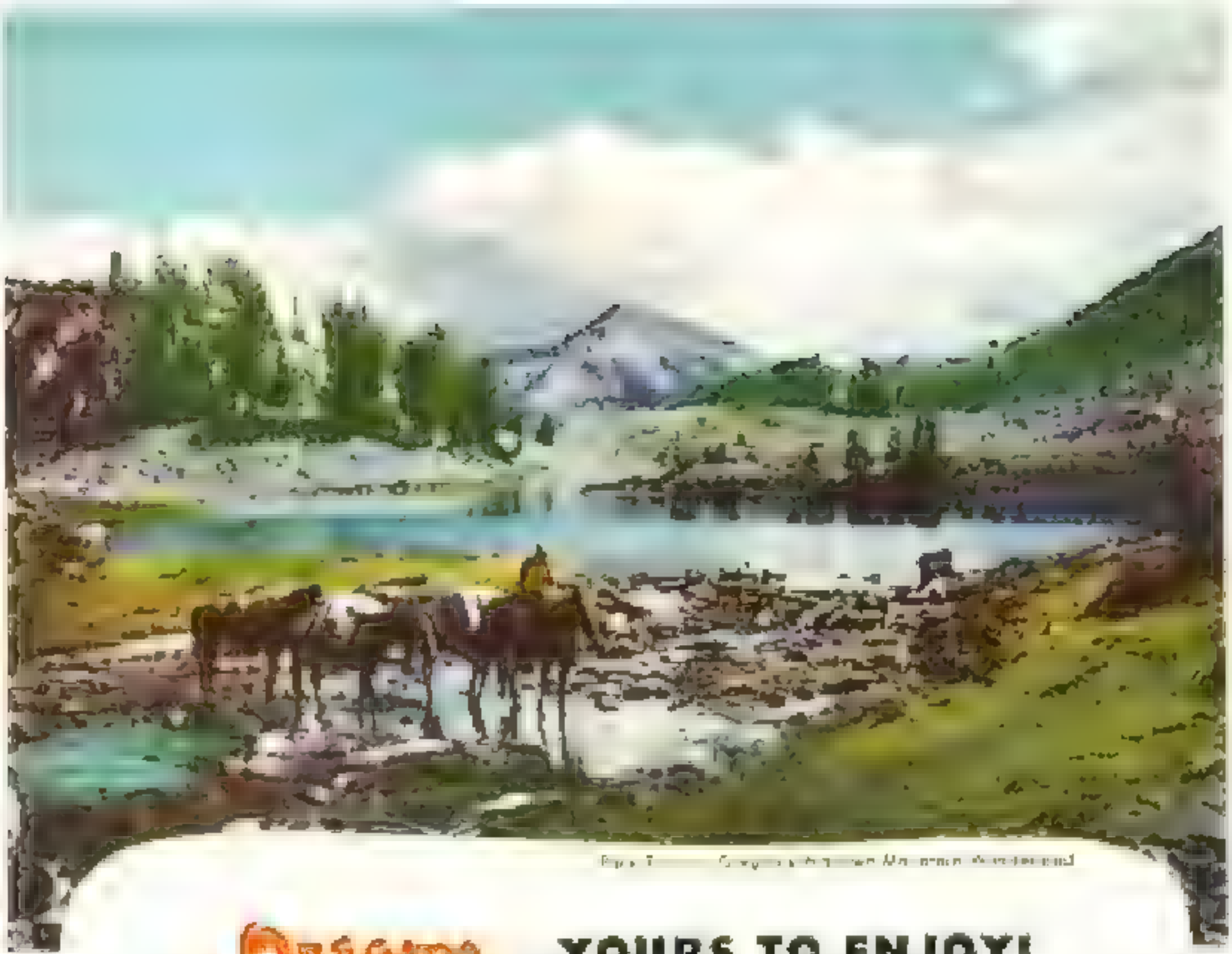

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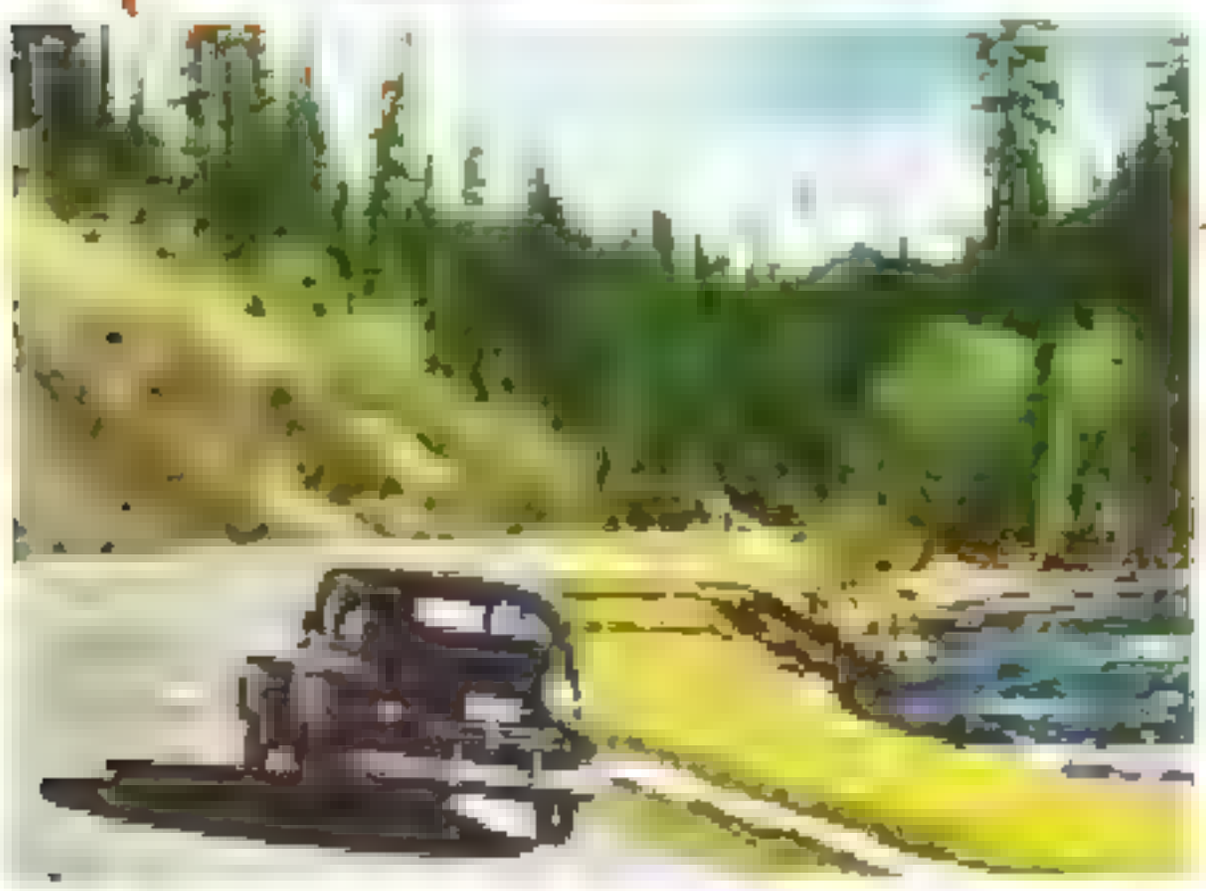

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[illegible]

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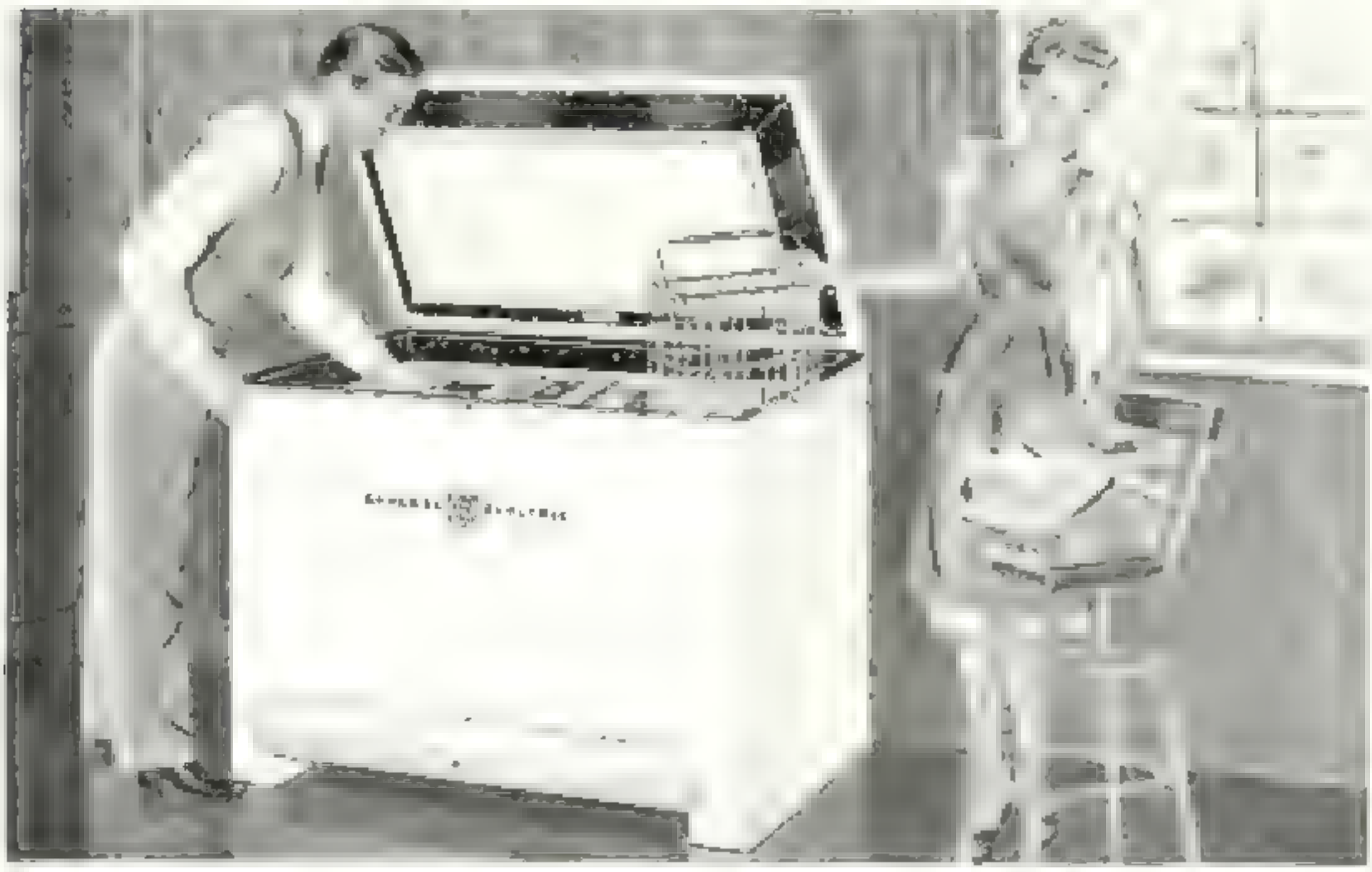
[illegible]



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Name

Address

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[illegible]

[illegible]

[illegible]

And what," you ask, "is an adequate return?"

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

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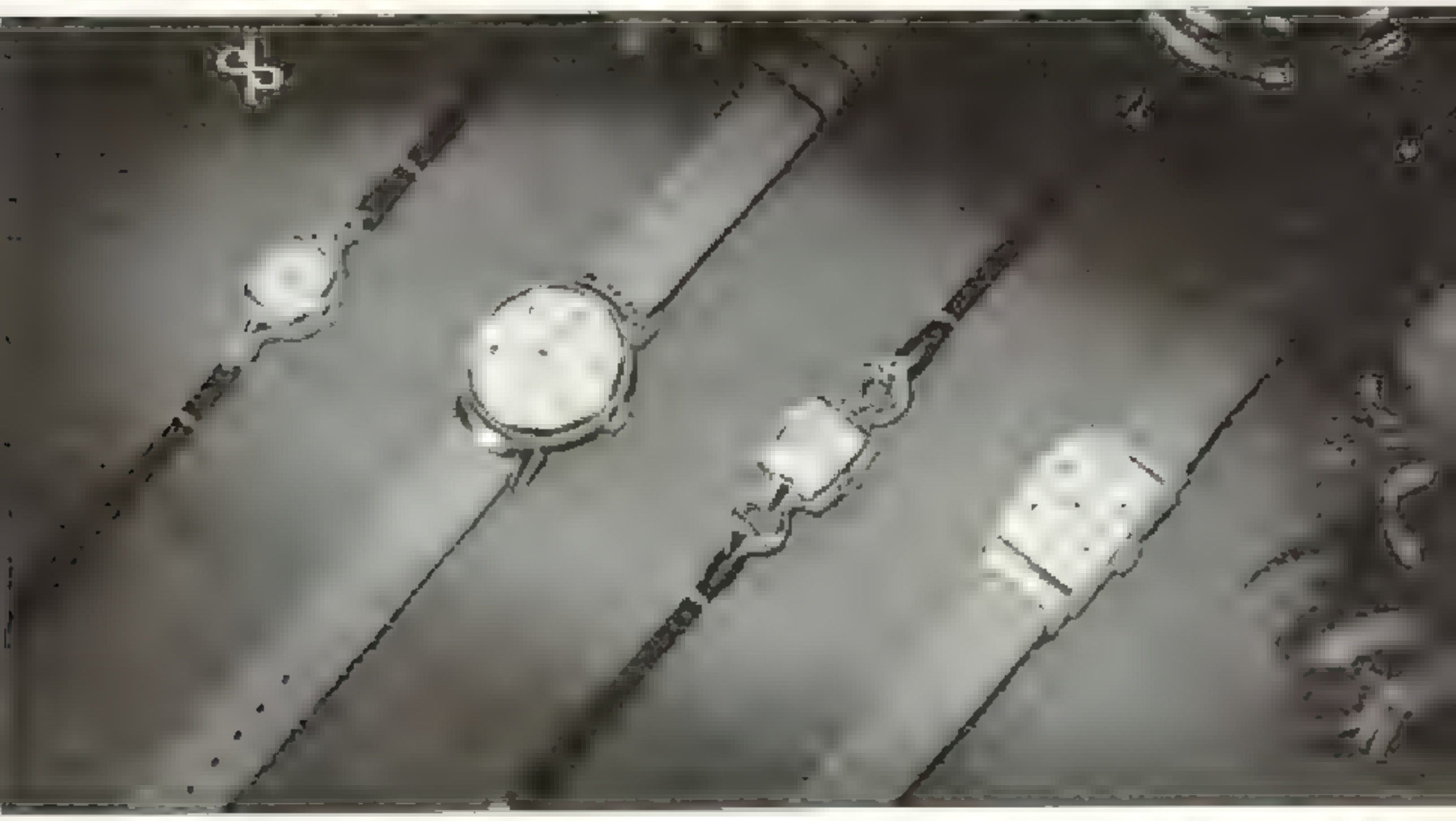

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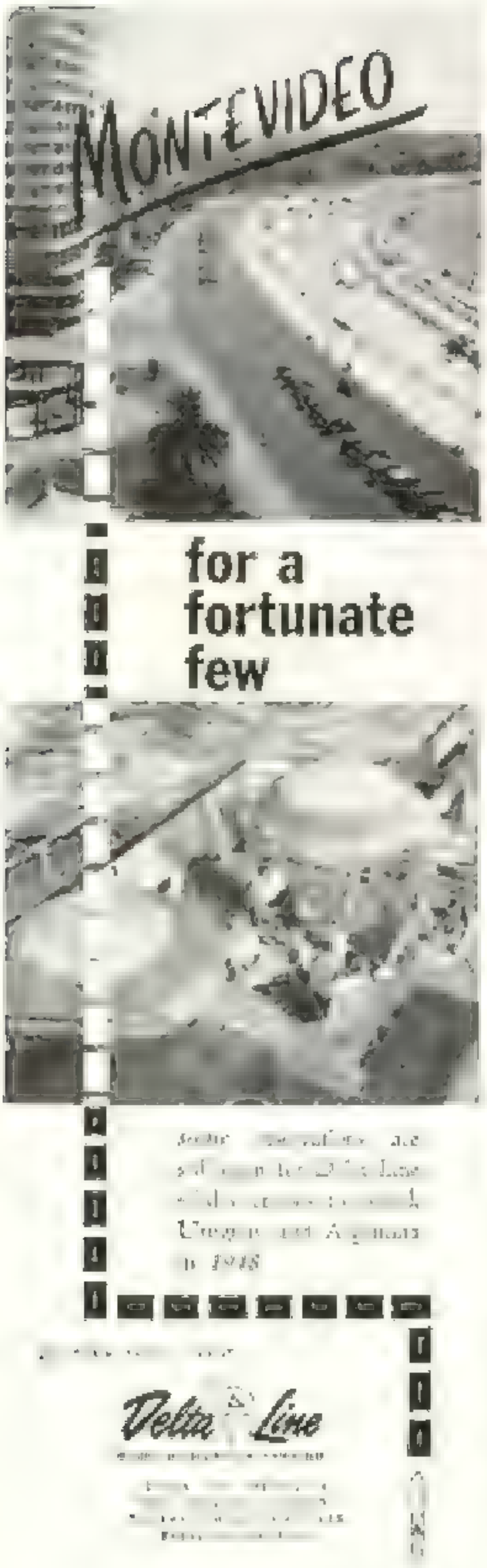
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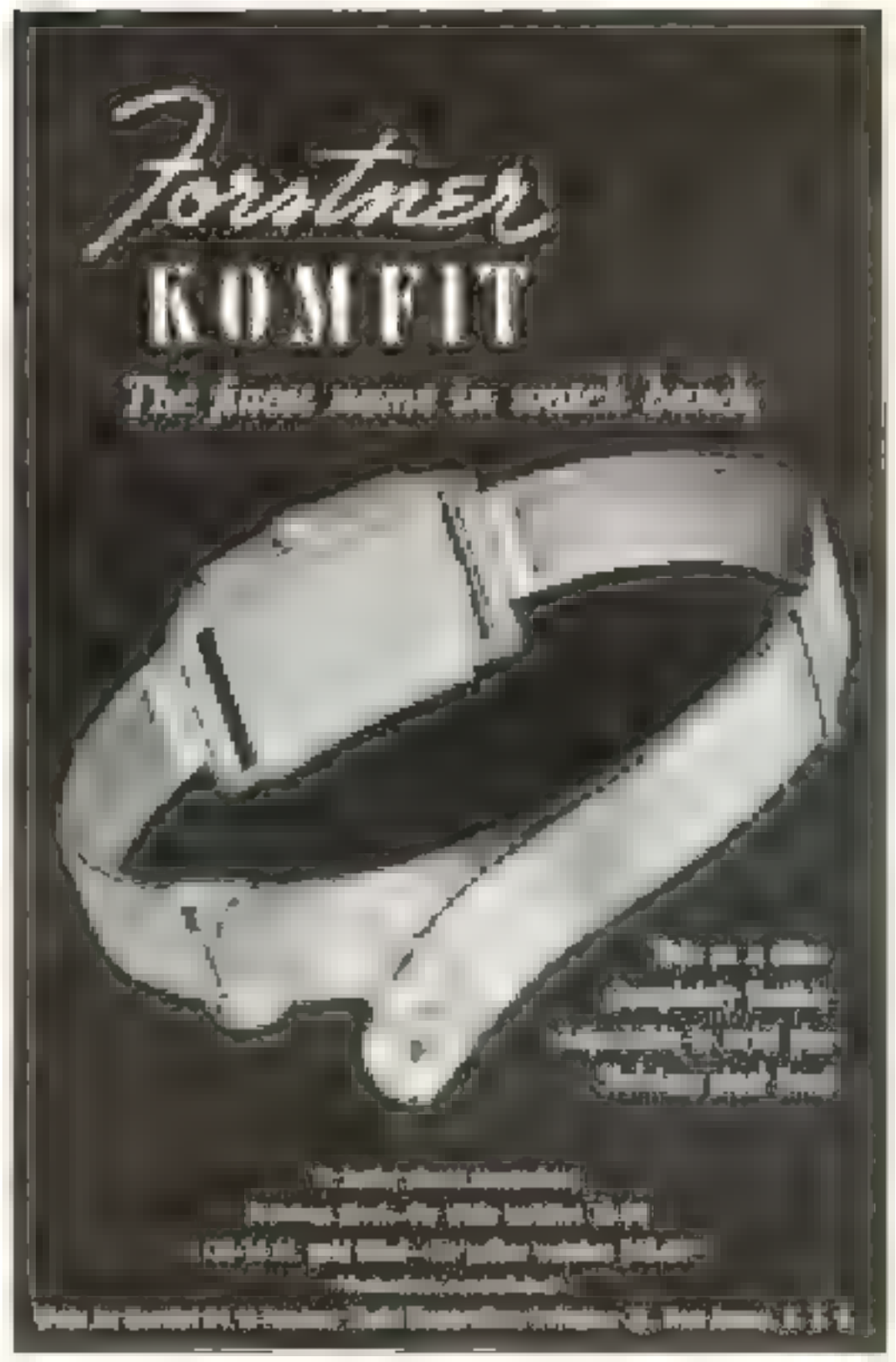
few
Delta Line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Most Photographers Use!"
Master II

For Larger, Lovelier Flowers Next Spring Plant Imported Holland Bulbs NOW!

You'll Have More Beautiful Spring Flowers

Imported Holland Bulbs Need Only Nature's Care

Just Picture Your Garden Next Spring.

FREE

No more arguments [illegible]

[illegible]

The Smiths, of Roslyn, N.Y., cheer for General Electric's

AUTOMATIC SLEEPING COMFORT

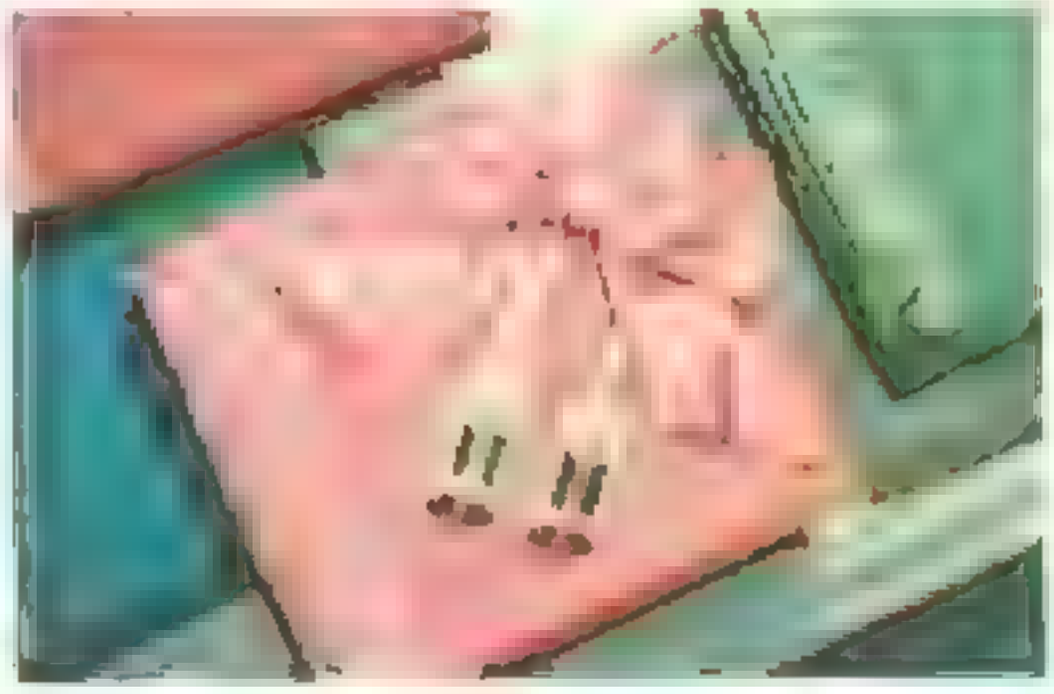
Cozy, restful sleep [illegible]

[illegible]

Automatic Blankets

FIRST IN SLEEPING COMFORT

Completely automatic [illegible]



Absolutely [illegible]

GENERAL ELECTRIC

Unlike father, unlike son

Here's a son who's going to have a hard time *looking up* to his father.

But Dad doesn't mind. He's proud of his boy — and of his college [illegible] that put the extra inches on [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

We're glad we've had a hand in helping develop that [illegible] food [illegible] will be [illegible] National Dairy [illegible]

ways to use milk and its many products.

This endless laboratory work with [illegible] is like exploring a new world. There's always a promise of something better for tomorrow.

[illegible]

These brands assure you of highest quality

NATIONAL DAIRY
PRODUCTS CORPORATION

San Diego

On the blue bay where California began

OLD MEXICO
Only 30 min. South
Horse Racing at Caliente

Live in the most even tempered winter climate that Southern California has to offer, in a city big enough to enjoy, yet giving easier access to the California-out-of-doors which you come for. Escape to the exotic pleasures of Old Mexico in a matter of minutes. No visa or passport needed. No Border delay. Then, there's a desert just through mountains lush with winter green. Thrill to the sun and the sea in a city so liveable you're sure to want to come back for more and more. Write for details on how to headquarter in San Diego for your finest Southern California winter.

THE DESERT
Close at hand

San Diego CALIFORNIA CLUB

HOTEL ACCOMMODATIONS NOW

[illegible] not necessary, but [illegible] your Travel Agent. If [illegible] nothing Difficult [illegible] enjoyment of your trip

ATTACH THIS CHECK LIST TO YOUR LETTER

NOTE: Do not come to San Diego seeking employment. Please print name and address clearly on your letter.

[illegible] Your [illegible]
[illegible] Birth [illegible]
[illegible] Arrival date

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Rm. 10, 499 W. Broadway, San Diego 1, California

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Ready for you in Sports and Rainwear!

● Byrd Cloth, the first lightweight fabric in the United States to combine wind resistance and water-repellency, has proven a sensational success on Admiral Byrd's Antarctic Expeditions. Take a tip from the Admiral and demand Byrd Cloth for the finest in sports and rainwear. *Ask your dealer for garments carrying the Byrd Cloth Label!*

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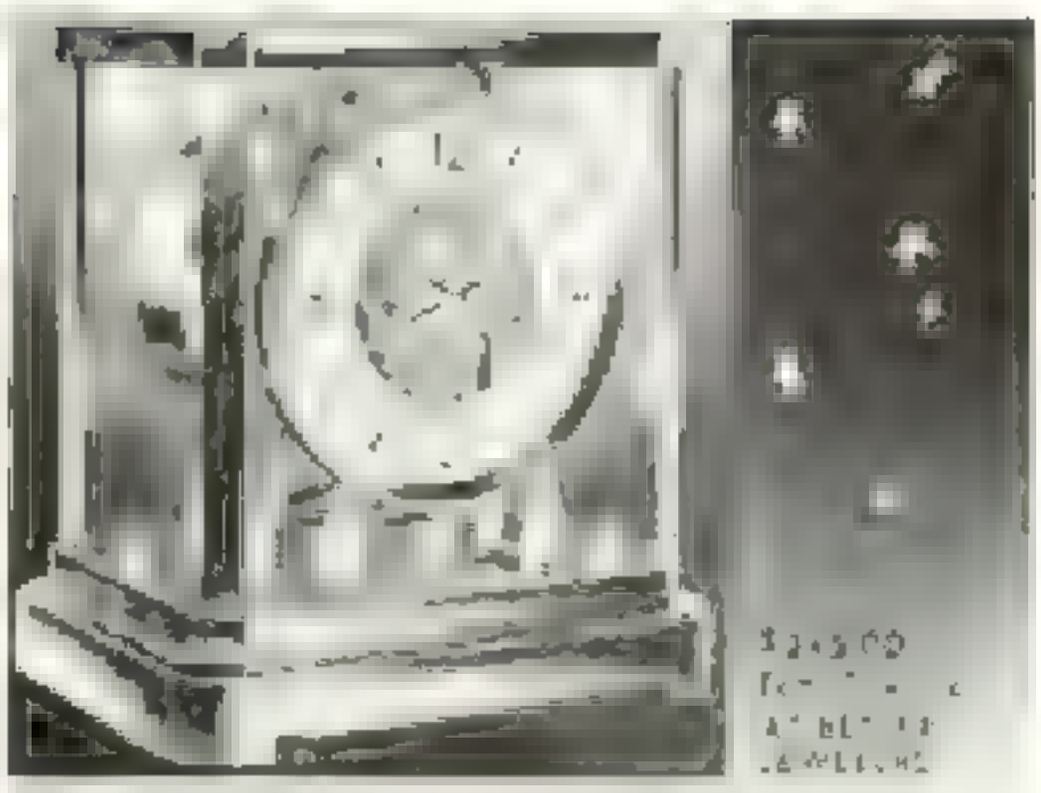

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THE PERPETUAL MOTION CLOCK
MADE BY LE COULTRE

Place Atmos on your mantel and watch its balance wheel, and it will run indefinitely without winding. [illegible] Atmos is powered by a [illegible] the temperature [illegible] Two [illegible] patent [illegible] Le Coultre [illegible] century old manufacturer of fine watches and clocks.

VACHERON & CONSTANTIN LE COULTRE WATCHES, INC.
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Your Pictures "Come to Life" on a DA-LITE Screen!

[illegible] Sold at less than [illegible] price by all photo dealers throughout the world.

DA-LITE

FREE BOOKLET!

[illegible]

Name

Address

City

Had your health checked lately?

Q. Why see a doctor when you're well?

A. Health is more than an absence of disease. A medical examination permits your physician to determine whether you are as healthy as you can be, *and should be*, to live and work at your best. Or if you are below par, the doctor can often catch and correct a trouble before a breakdown occurs. Most people should have such examinations once a year. In certain cases, and for people over 55, more frequent checkups may be desirable.

Q. Are "Fifth Column" diseases threatening you?

A. Diseases such as high blood pressure, cancer, tuberculosis, heart ailments, and diabetes may develop without any warning symptoms. But they can be detected by your physician, helped, when necessary, by blood tests, urinalysis, X-ray, fluoroscope, electrocardiograph, or other diagnostic aids. Annual examinations will usually lead to the discovery of "fifth column" diseases *in their early stages*, when modern medical science can do most to control or cure them.

Q. What about your daily living habits?

A. As part of your physical examination, the physician will probably check your daily living habits. He may ask about the amount and kinds of food you eat, whether you are getting sufficient rest and exercise, or how you use your leisure time. Knowing your daily habits may enable him to guide you to better mental and physical health. By following his instructions you may help assure yourself a longer, happier life.

To help you protect your health by observing sensible habits and simple precautions, Metropolitan has prepared a leaflet on selecting foods and one on general health habits as related to age. Write for free leaflets 107-N.

Metropolitan Life Insurance Company

TO VETERANS—IF YOU HAVE NATIONAL SERVICE LIFE INSURANCE—KEEP IT!

Music's Magic Spell... [illegible]
by this magnificent FM AM radio phonograph

[illegible]

[illegible]

[illegible]

[illegible]

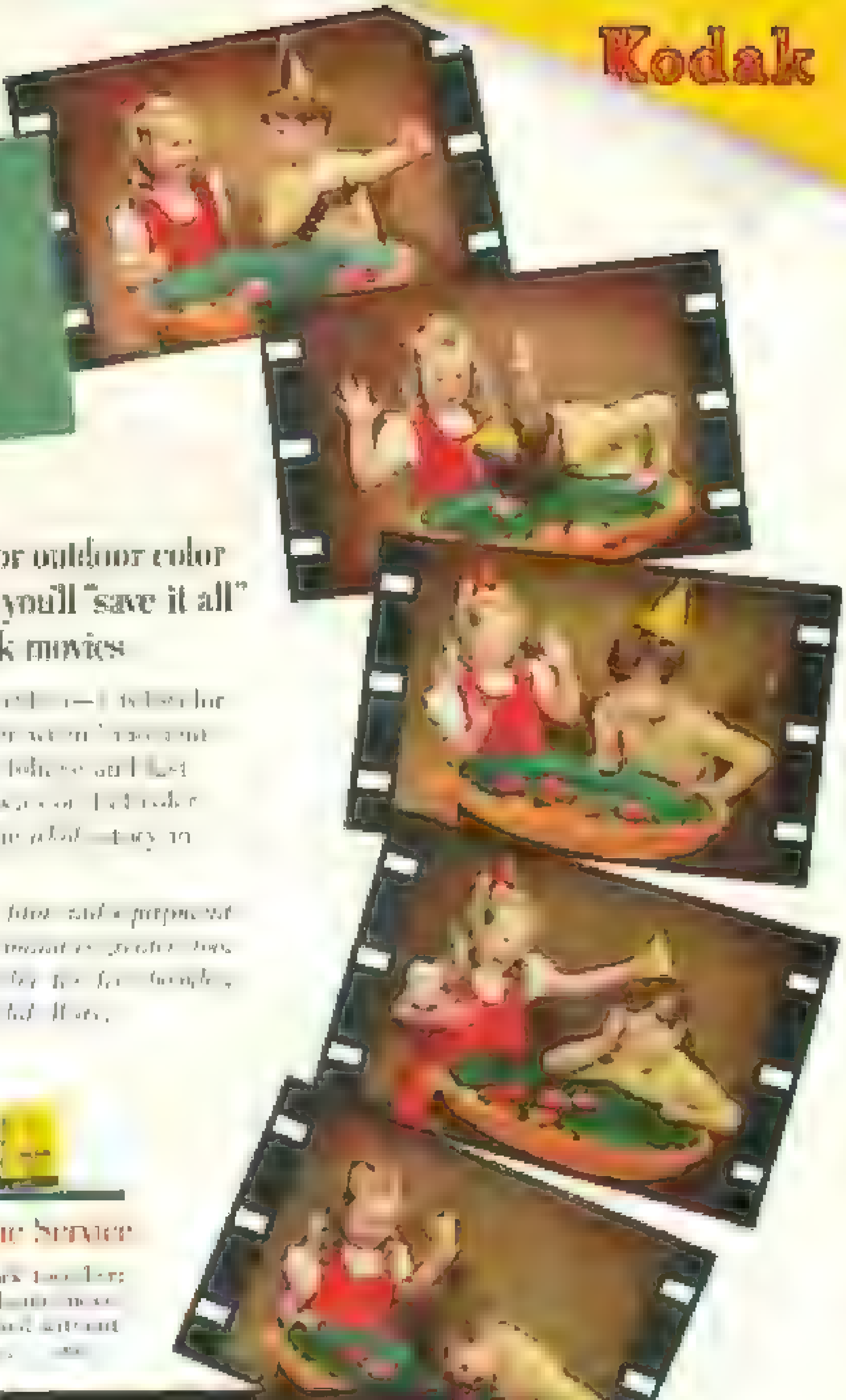
[illegible]

GENERAL ELECTRIC

RADIO-PHONOGRAPHS

CONTINUOUS QUALITY IS QUALITY YOU TRUST

Kodak



Movies in Color

Kids' party indoors...or outdoor color and action...some day you'll "save it all" —in Ciné-Kodak movies

WONDERFUL to look forward to — [illegible] for *action diary* . . . "remember when" record of childhood . . . brilliant foliage and fast moving sports of fall. Movies on full-color Kodachrome Film save the *whole* story in vivid detail.

Kodak is making more film and equipment than ever before, but the demand is greater. Now see your dealer and ask for the free booklet, Home Movies the Ciné-Kodak Way.

Kodak's Complete Movie Service

All Kodak [illegible] designed to work together: Ciné-Kodak, [illegible] the popular home movie camera . . . [illegible] without extra [illegible] Kodak [illegible] Kodascope, the projector that shows your movies crisply to friends. EASTMAN KODAK COMPANY, Rochester 4, N. Y.

Carriages without horses shall go, and accidents fill the world with woe.

Prophecy 1641

Prophecy 1641 - Fact 1947

The London of 1641 may have rend with amusement this prophecy attributed to a certain Mother Shipton. Yet its truth is a tragic fact today.

In 1946 automobiles killed 33,500 Americans. In 1947 careless driving continues on our streets and highways.

The following "common sense road rules," which Lumbermens first published in 1926, have stood the test of time—have proved that "Accidents Are Preventable." Follow them—they will save lives, perhaps yours.

1. Remember the life of motor cars isn't in a "traffic emergency."
2. Keep your position on left as much. If you want to pass a car, do it on the least congested way.
3. Let approaching car go by before passing car ahead.
4. Slow down for the car that wants to pass you.
5. When you have to stop, pull entirely off the pavement.
6. Be watchful for children.
7. Stop for a standing school bus.
8. Wait for the signal to "go," don't "jump" the lights.
9. "Stop, Look & Listen" at unguarded crossings.

"If you don't, don't drive. If you drive, don't drink."

For safety on the highways, for safety in business, look to Lumbermens Automobile, Public Compensation Group, Life, Hospital Insurance and Bonds, through local agents, nationwide and in Canada.

Reprinted from Lumbermens booklet, "Accidents Are Preventable," containing common sense road rules, illustrated with 40 full page photographs. Individual copies available on request. Write Dept. P. A. 4.

Lumbermens MUTUAL CASUALTY COMPANY

Chicago 6, Illinois

This is the LONG and SHORT of Greyhound Travel!

The **BIG MAN** and the **LITTLE GIRL** are pictured here to remind you that Greyhound offers just as attractive service on *short trips* as on *long ones*.

Greyhound has gained World fame for carrying millions of passengers, in cushioned comfort, to all of the 48 States, up into Canada and down in Mexico. But it also offers frequent *local* service in nearly all parts of America . . . convenient trips to nearby towns . . . to schools, factories and farm communities . . . hundreds of which have no other public transportation.

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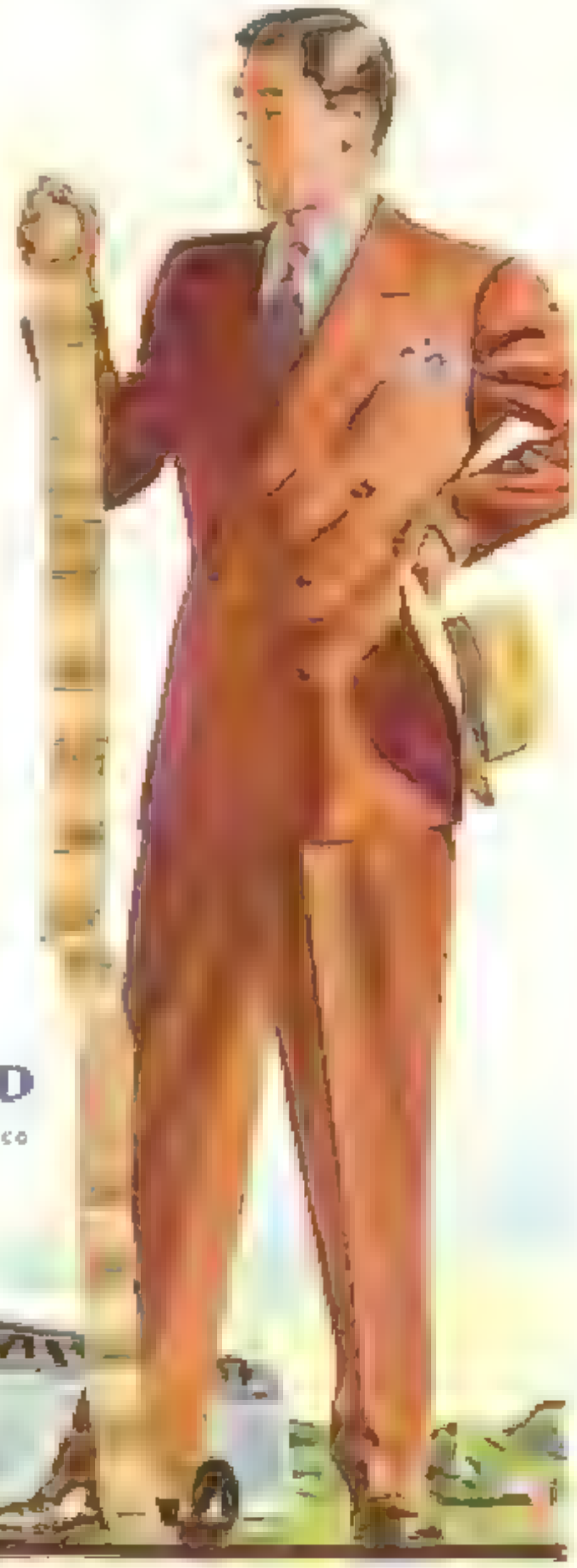

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_____ *1947*

To the Secretary, National Geographic Society,
Sixteenth and M Streets Northwest, Washington 6, D. C.:

I nominate.....

Occupation _____
(This information is important for the records)

Address _____

_____ *for membership in The Society.*

_____

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Name and Address of Nominating Member

10-47

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One is for Everybody

One is for Everywhere

One is for Efficiency

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It's the tone of voice, the warmth and friendship, the helpfulness which you have come to expect of telephone people.

The Operator reflects it when she puts through your call promptly and courteously. The girl in the Business Office shows it when she goes out of her way to take care of your needs. The Installer practices it when he brings willingness and good nature, as well as a telephone, to your home.

It all adds up to pleasing service for you—from many thousands of telephone people, all along the line.

BELL TELEPHONE SYSTEM

Pictured here is the old red fort at Delhi. Its architect also designed India's famous Taj Mahal

—to India in "vacation ship" luxury

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